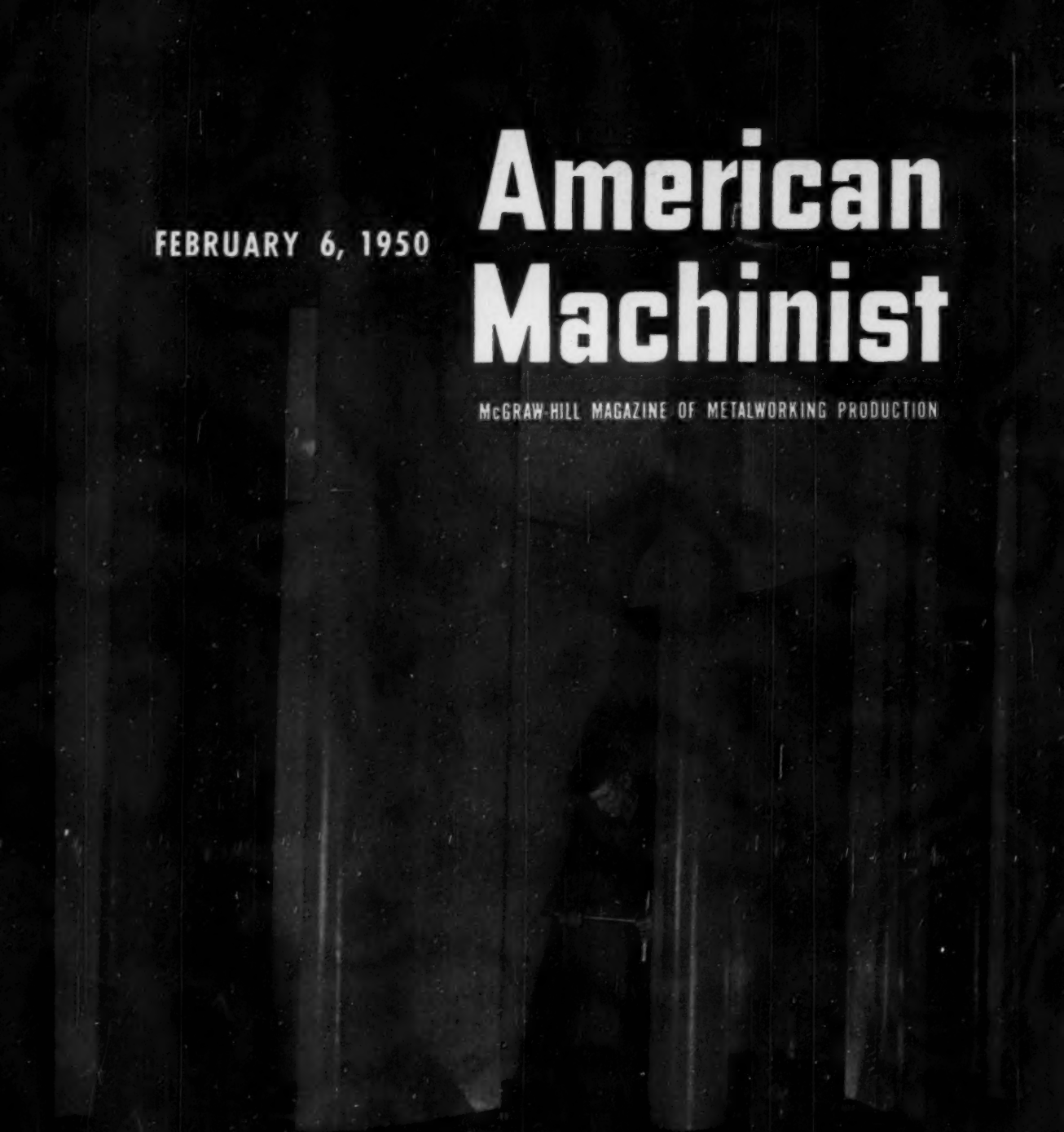
FEBRUARY 6, 1950

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION



Assembling a hydraulic turbine — see page 2

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American Machinist

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CONTENTS for FEBRUARY 6, 1950

VOL. 94 NO. 3

Cover ..... *Operation pictured is described on page 2*

ADMINISTRATION

Editorial ..... *Burnham Finney* 71
Boost Output of Multiple-Slide Presses—I ..... *Otto C. Held* 73
Small Shop Plan Keeps Production Moving ..... *L. C. Beatty* 78
Kickbacks ..... *Round Table* 106

SPECIAL REPORT

How to Work Clad Materials ..... *Wm. M. Stocker, Jr.* 89

ENGINEERING

Selection of Transfer Machines ..... *Rupert Le Grand* 84
Scrap-Strip Allowances for Blanking Dies ..... *J. R. Paquin* 86
Carbide Insert and Tool Standards ..... *(RBS)* 123

MATERIAL CUTTING, FORMING

Fast Setups for Machining Small Die Castings ..... *Herbert Chase* 80
Emergency Broaching Job Forms Hex Sockets ..... *C. D. Mackinnon* 108
Balancing Disks Smooth Out Rotation ..... *Paul Grodzinski* 110
Sawblade-Broach Slots Keyways ..... *James Harrington* 110
Rounded-Stock Stops Shed Chips and Dirt ..... *Dan Penway* 110
Mechanical Tool Lift Rolls Along Shaper Work ..... *S. Framurz* 112

MATERIALS HANDLING

Trucks Slash Handling Costs on Curved Disks ..... *Henry M. Pratt* 88

TOOLING

Drillhead-Jig Combination Drills Rocker-Arm ..... *Ben C. Brosheer* 77
Air Clamps Hold Paint Stencil 83
Double Fixtures Cut Downtime ..... *Herman J. Shaefer* 105
Sighting Ring Produces Accurate Drill Jigs ..... *S. H. Pearson* 107
Midget Vacuum Cleaner ..... *W. Chiodo & A. Chancellor* 107
Shaft Coating Eliminates Bearing Adjustments ..... *Frank Biechele* 107
Spring-Winding Block Gripped in Toolholder ..... *Edward E. Anderson* 108
Drill-Jig Clamp Grips Parts Quickly ..... *H. G. Frommer* 108
Indicator Rod Checks Taper Setups on Lathe ..... *H. Moore* 109
Radial Drill Jig Taps Extra Large Thread ..... *K. N. Natarajan* 109
Shaper Rig Positions Blanks for Gear Cutting ..... *Gerhard Wenke* 109
Punches Located by Centering on Tapers ..... *Alfred P. Rheingold* 110
V-Block Grips Stock in Four-Jaw Chuck ..... *Roger Isetts* 110
Spring Center Aids Hand-Tapping Job ..... *Allan B. Nixon* 111
Vise Adapters Widen Clamping Range ..... *George F. Burnley* 111
Scribing Tool Marks Off Accurate Circles ..... *Tyler G. Hicks* 111
Magnet Braces Sheet Metal ..... *Roger Isetts* 112
Right-Angle Screwdriver Driven by Gears ..... *Frank J. Peragine* 112
Square Stock Chucked ..... *Frank Biechele* 112

NEWS OF METALWORKING

Spot News 67
Gaging Metalworking 68
Detroit News 118
Names in the News 119

DEPARTMENTS

Reference Book Sheets 123
Talking Shop 129
Equipment, Materials, Parts 130
Round Table Discussions 150

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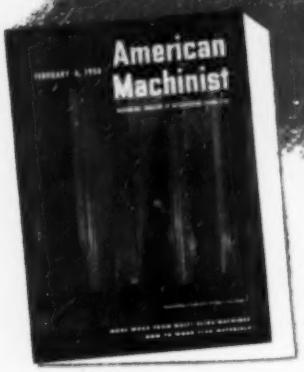


Clips and Quips

Our Cover . . . Ellerd Striegel works on the wheel nose of the rotor for a 6,975-hp, 21-ft head, 80-rpm hydraulic turbine on the erection floor at Allis-Chalmers. It will go in to the St. Mary's Falls power plant. The colorful Kodachrome was taken by Michael Durante.

Clad Metals . . . Assistant Editor Bill Stocker has been going from plant to plant, pumping them for their "know-how" on fabricating clad metals. He has the latest on machining, forming and welding of all the types of clad materials most commonly used in industry in our current Special Report.

Multi-slide Machines . . . For years we've tried to put together a story on tooling multi-slide machines. But it's a complex descriptive job. We have at last, however, discovered an author that knows his stuff. Otto C. Held did some intensive work in multiplying multi-slide output for a major electrical producer. In a 3-part story beginning in this issue he tells how to tool, what auxiliaries and controls to provide, and how to plan operations. Details of design of auxiliaries and controls are included.

Blanking Allowances . . . J. R. Paquin, tool engineer at Underwood, is back in this issue again, with an article on how to apply scrap-strip allowances for blanking dies. He discusses rules worked out from practice with single- and double-pass layouts that help the die designer give the scrap strip enough strength without wasting material.

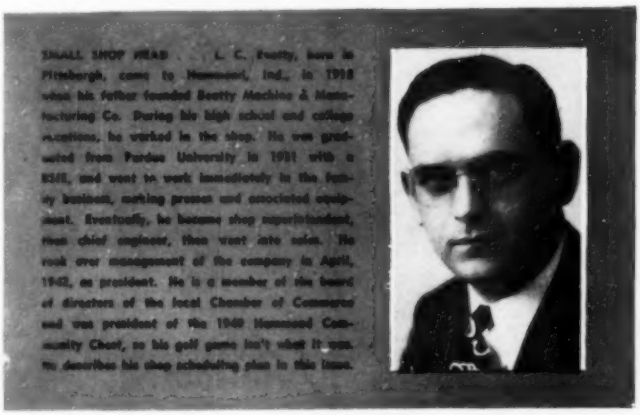
Short Articles . . . Several interesting ideas are presented in compact space. For example, the use of special fork trucks to load disks in the box cars, cutting loading time from 40 *hours* to 40 *minutes*, and eliminating damage to the disks. Another one is the use of air clamps to hold stencils in painting the Studebaker truck tailgate. Another deals with Cadillac methods of selecting transfer machines. This article gives the economics of transfer machines for limited-quantity production.

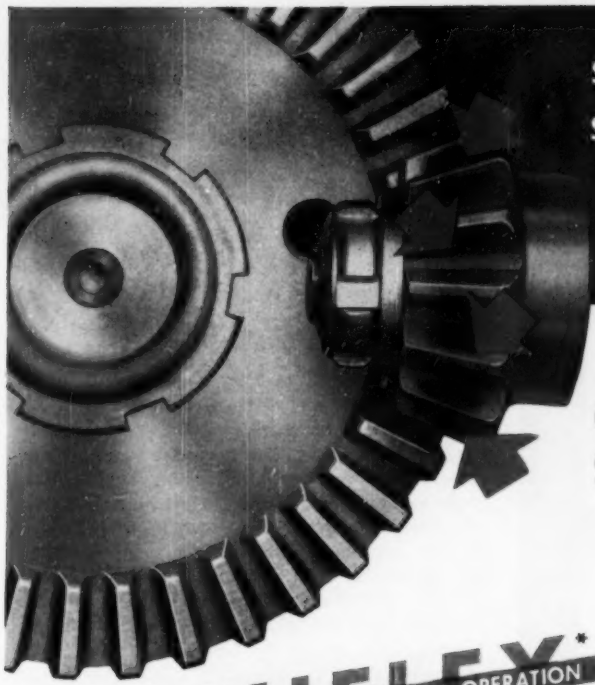
Candy to Customers . . . Lindberg Engineering Company, Chicago, believes in sweetening up its customers at Christmas, but there must be a sound tie-in with company products. In 1947, the company handed out aluminum salad forks and spoons made in its own foundry. In 1948 it was Christmas carols sung by the company chorus and recorded on vinylite. But this year, it was *really* sweet. Some 2,000 lb of candy was cooked on a Lindberg pit-type furnace, packaged in boxes showing a picture of the Lindberg head office. Each box contained fudge and chocolate-covered nuts, with pictures of Lindberg girls producing the fudge.

Small Shop Control . . . Beatty Machine and Manufacturing Company has small-quantity production but controls all machining operations closely. L. C. Beatty, president, shows how his system works. . . . In this same issue, Herbert Chase describes some operations of General Motors Rochester Products Division, showing unusual mass-production tooling setups for filing machines, broaches, special drills, and the like. All are smart kinks for the man who must machine small die castings.

Foreign Articles . . . From time to time we have published articles from foreign sources. We could get more of them, but don't know how you feel about it. If you would be interested in reading more about how things are done in other countries, drop us a line.

Coming . . . Feb. 20 *AM* will include a Special Report on abrasive-belt grinding, plus articles on eliminating punch-press injuries, on mechanizing finishing, on sectional dies, inventory control, shaving and deburring gears. The cover will show multiple tooling on a shaper, and Otto Held continues his series.


SMALL SHOP HEAD . . . L. C. Beatty, born in Pittsburgh, came to Hammond, Ind., in 1918 when his father founded Beatty Machine & Manufacturing Co. During his high school and college vacations, he worked in the shop. He was graduated from Purdue University in 1931 with a BSME, and went to work immediately in the family business, starting presses and associated equipment. Eventually, he became shop superintendent, then chief engineer, then went into sales. He took over management of the company in April, 1942, as president. He is a member of the board of directors of the local Chamber of Commerce and was president of the 1949 Hammond Community Chest, so his golf game isn't what it was. He describes his shop scheduling plan in this issue.



SUPERIOR STRAIGHT BEVEL GEARS WITH LOCALIZED TOOTH BEARING

Cut on the Gleason No. 14 Straight Bevel Generator

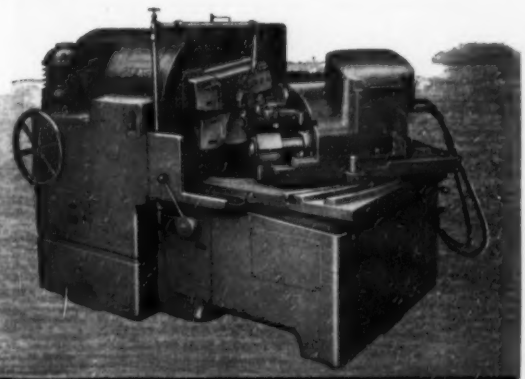
CONIFLEX* GEARS ARE SMOOTHER AND QUIETER IN OPERATION THAN ORDINARY STRAIGHT BEVELS.

CONIFLEX GEARS HAVE ANY DESIRED AMOUNT OF LOCALIZATION OF TOOTH BEARING.

CONIFLEX GEARS HAVE WIDER OPERATING TOLERANCES.

CONIFLEX GEARS ARE EASIER TO ASSEMBLE.

Coniflex gears are produced on the Gleason No. 14 Straight Bevel Generator. Through simplified bearing control during gear manufacture, greater flexibility of the gears for assembly and for operation is obtained. With *controlled tooth bearing* the operator is able to build into every gear a tooth bearing which will carry the best possible operating advantage.



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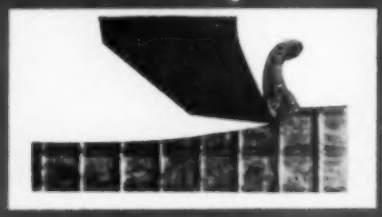

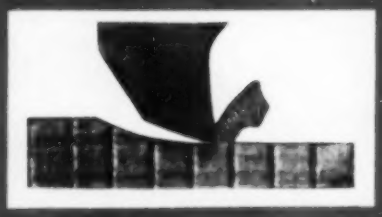

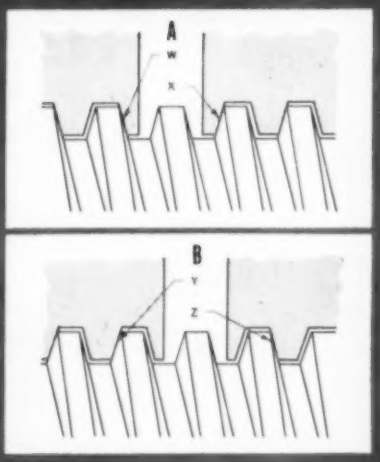

Above: These two sketches show how backlash is automatically eliminated in the table feed screw. Two nuts are employed, which tend to rotate in opposite directions. In A, the internal threads of the nuts are firmly seated against opposite sides of the feed screw threads, points W and X. No backlash. In B, direction of rotation of the lead screw has been reversed. Threads snugly seated at points Y and Z. No backlash.

A prominent metal working paper states, "climb milling is best if equipment permits." You may not agree with this statement, but climb or down-milling is highly desirable in these two cases: 1) thin parts, difficult to clamp; 2) where breakout of metal at the end of the cut cannot be tolerated. ¶Work of this type is just routine for CINCINNATI knee-type milling machines. Down-milling and up-milling can be handled with equal facility. No adjustment or other preparation is required. That's because the threads of the table feed screw and nut are always snug; there's no backlash. It's automatically eliminated by means of a patented built-in device, Automatic Backlash Eliminator. This feature alone gives CINCINNATI knee-type milling machines a head start in reducing costs in your shop.

CINCINNATI No. 2MI Milling Machine, built in plain, universal and vertical styles. The No. 2ML incorporates the same design features. Built in plain and universal styles.

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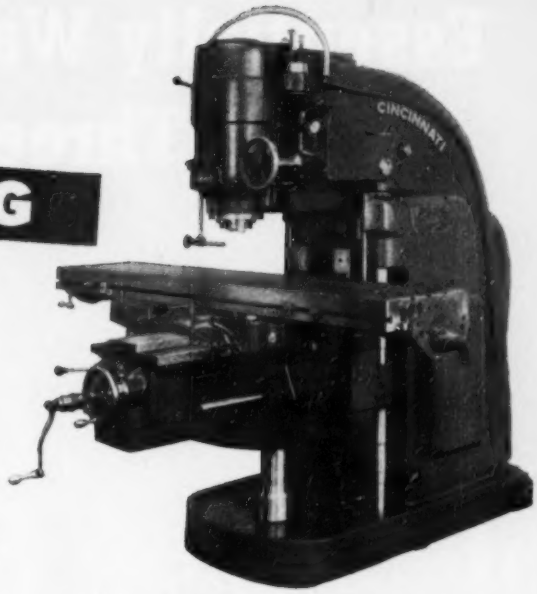
Other exclusive cost reducing features:

a) **Dynapoise overarm**—increases cutability
b) **Power speed and feed change** (Dial Types) **Hydraulic shifting** of spindle speed gears (Nos. 2ML and 2MI)
c) **Independent directional control levers**—simplify operation

Complete data is contained in literature. It's yours for the asking. Condensed information will be found in Sweet's Catalog File.



CINCINNATI Dial Type Milling Machine. Built in Nos. 2, 3 and 4 sizes; plain, universal and vertical styles; high and medium speed ranges. Vertical style illustrated.

CINCINNATI Dual Power Dial Type Milling Machine. Built in Nos. 3, 4, 5 and 6 sizes; plain and vertical styles; Nos. 3 and 4 sizes; universal style. High Power Dial Type incorporates the same design features.

TYPE OF MACHINE	AUTOMATIC BACK-LASH ELIMINATOR		CATALOG NUMBER
	Included	Extra	
Nos. 2ML and 2MI		X	M-1662-1
Dial Type		X	M-1623-2
High Power Dial Type	X		M-1644
Dual Power Dial Type	X		M-1647

Right: Down-milling greatly facilitates the operation illustrated here. The parts are cast iron tables; two of them are milled in one pass on a CINCINNATI No. 5 Dual Power Dial Type.

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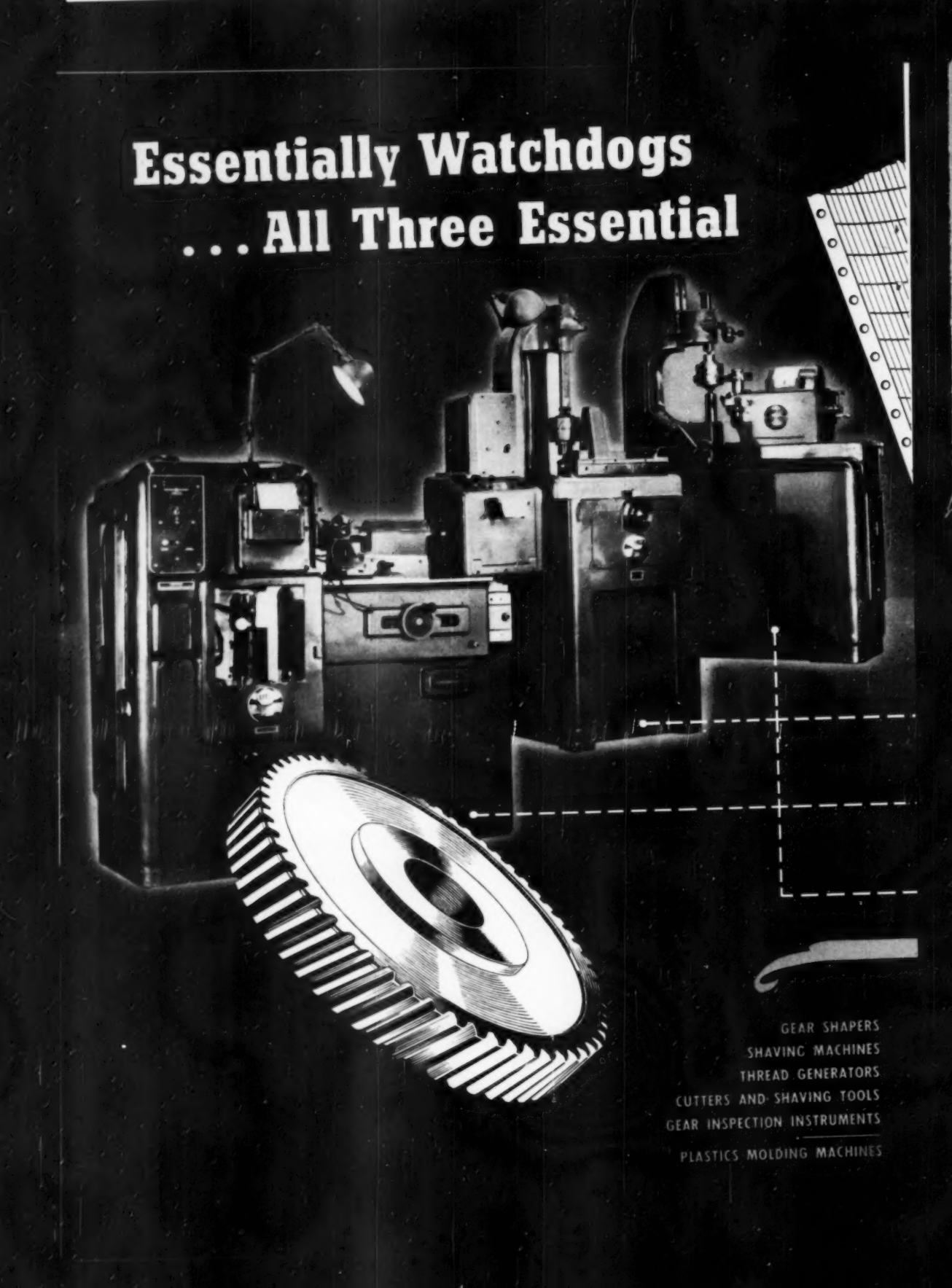

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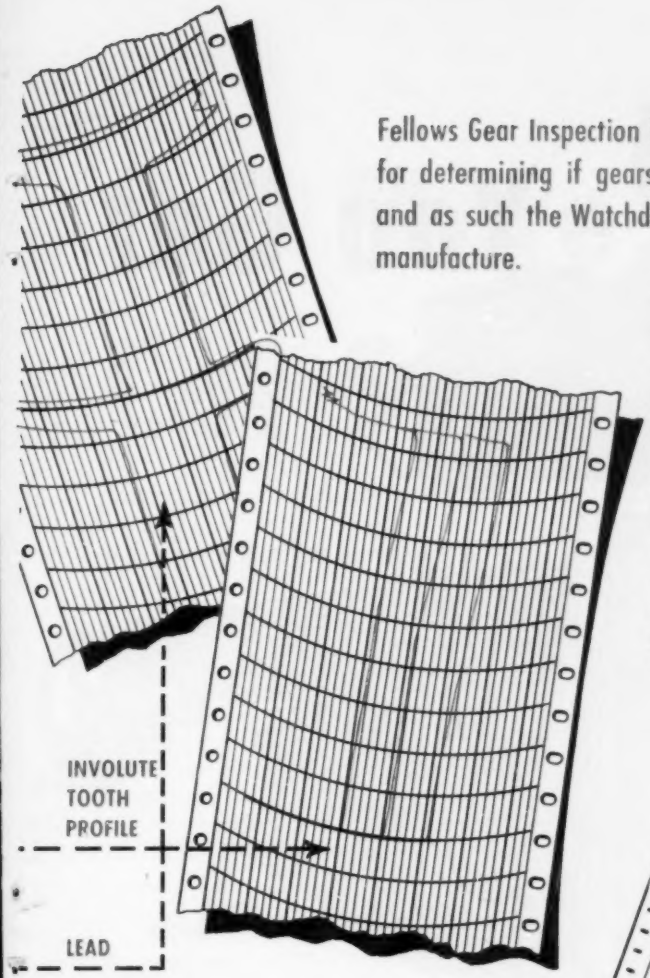

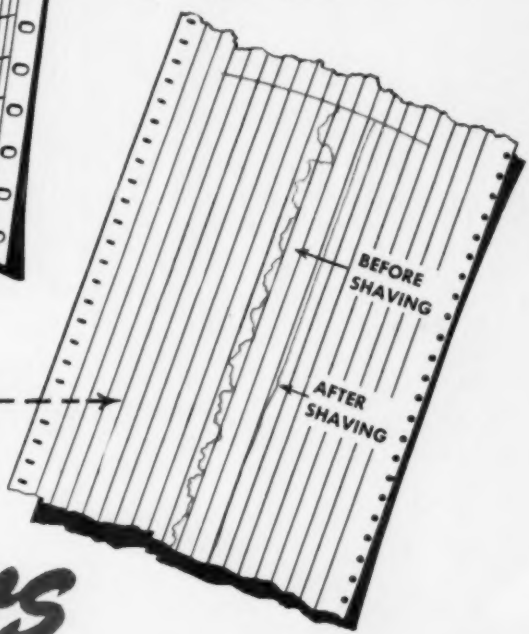

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Out More Work... Cut Setup Time

WITH THE VAN NORMAN NO. 22L RAM TYPE MILLER

Here's a versatile miller that meets practically all milling requirements. The adjustable cutterhead enables you to perform conventional horizontal or vertical, as well as angular milling, with one machine. It saves set-up time because most jobs can be carried through to completion without changing the work set-up.

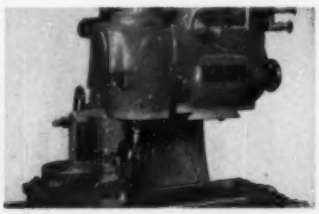
The movable ram in combination with the saddle cross feed increases the work range, enables you to handle larger work.

Front and rear direction controls, large dials on the hand adjustments, quick-change speed and feed selectors simplify operation . . . reduce operator fatigue.

The Van Norman No. 22L is available with plain or universal saddle. Investigate this miller as well as other Van Norman Ram Type and Horizontal Millers today. They will help you speed production and cut your milling costs. Write for catalog describing these versatile millers.

HORIZONTAL MILLING— With the head locked in the horizontal position, the 22L mills a slot in the workpiece. Hardened stop set at factory assures positive 0° setting.

ANGULAR MILLING— Milling a "V" in the workpiece. Note that the work is still in the original setup . . . saving setup time and assuring accuracy.



VERTICAL MILLING — Face milling operation with cutterhead in vertical position. Permanently fixed hardened stop permits easy setting of cutterhead at 90°.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Cut Threads

BETTER FASTER CHEAPER

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1. LANDIS DIE HEADS cut tool cost by using chasers that are independent units. Worn or damaged chasers are reground or replaced individually, without affecting the remaining chasers of the set.

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3. LANDIS DIE HEADS cut all diameter threads with a constant pitch and form within the rated range of the die head with a single set of chasers. Short thread lengths larger than the rated diametrical range can be cut with the same die head equipped with over-size chaser holders.

4. LANDIS DIE HEADS use chasers that can be reground to 80% of their length. Regrinding is a simple operation restoring the entire cutting edge and leading feature, yet retaining the initial accuracy of pitch, diameter, and depth of cut.

5. LANDIS DIE HEADS improve thread finish and cut production costs by reducing chaser wear and breakage. The tangential position of the chaser to the work allows lateral absorption of cutting strains. Resulting reduced friction and vibration make higher cutting speeds possible without causing thread distortion or chaser breakage.

6. LANDIS DIE HEADS consistently produce threads accurate for lead. Regrinding does not destroy the lead controlling feature of the chasers. Thus this feature assures accurate pitch threads throughout the chaser's life.

7. LANDIS DIE HEADS are built to stay on the production line. Tough, high-carbon steel is used in all parts. Rigid construction maintains accuracy, and minimizes wear of working parts. Landis Die Heads are furnished in two models, heat-treated or hardened-and-ground, depending on the application and quality of thread desired.

LANDIS Machine COMPANY

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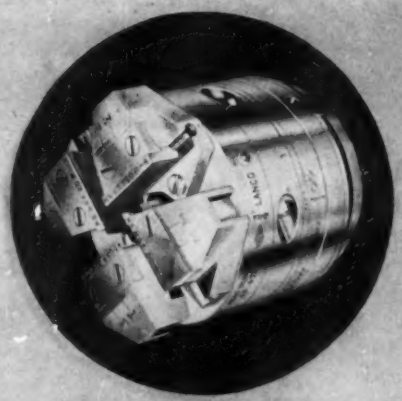
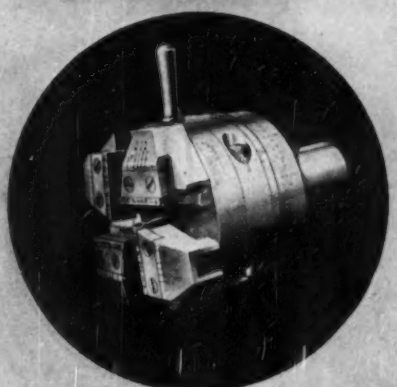
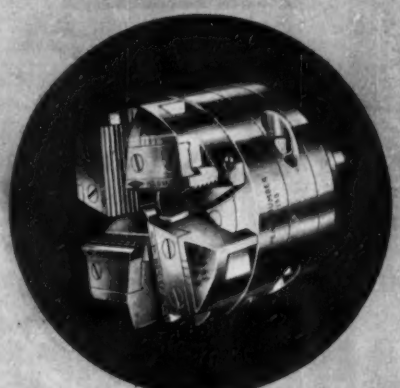


LANCO—a revolving die head for hand-operated semi-automatic, and automatic threading machines.



LANDMATIC—a stationary die head for turret lathes.



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Save time ON YOUR GRINDING SETUPS

One machine for all these jobs . . . .

LANDIS TOOL
Precision Grinders

12" Diameter Swing
28" Between Centers
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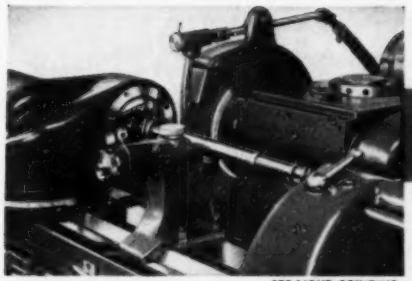
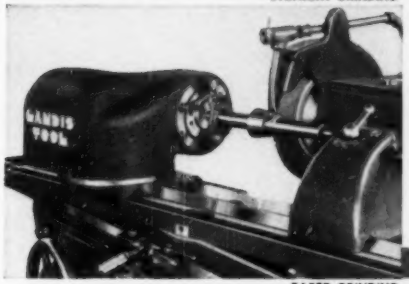
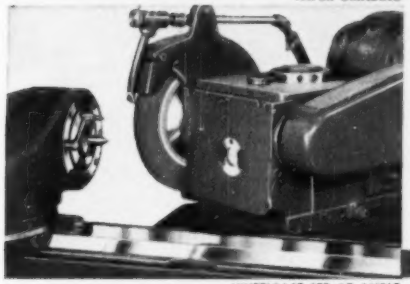
3,250 Pounds Net Weight
51"x105" Floor Space
A.C. Operation



STRAIGHT GRINDING

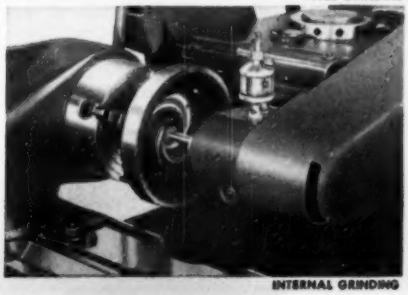


TAPER GRINDING



WHEELBASE SET AT ANGLE

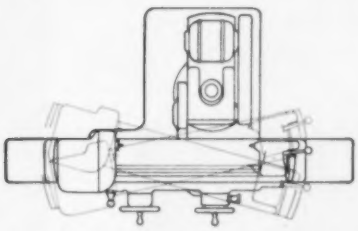
FACE GRINDING



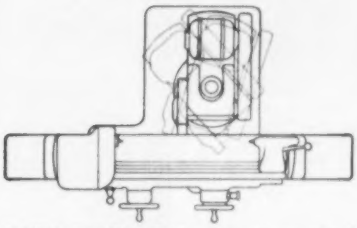
INTERNAL GRINDING

the NEW LANDIS TOOL *Grindwell*

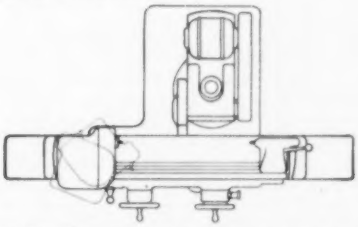
a low cost, general purpose, Universal Grinder



WORK TABLE SWIVEL—Calibrated scale at end of table for setting angle of taper grinding up to 24° included angle or 5" per foot. Center scale graduated for turning table 90° either direction.



GRINDING WHEEL SWIVEL—Calibrated scale so wheel head can be set for angle up to 90° in either direction to eliminate work piece interference or dress angle on face of wheel.



HEADSTOCK SWIVEL —Calibrated scale so angle up to 90° in either direction can be set for face grinding and tapered external or internal grinding of chucked work pieces.

116

For detailed features and specifications, request Bulletin 549, illustrated.

LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

ELIMINATE EXCESSIVE HANDLING

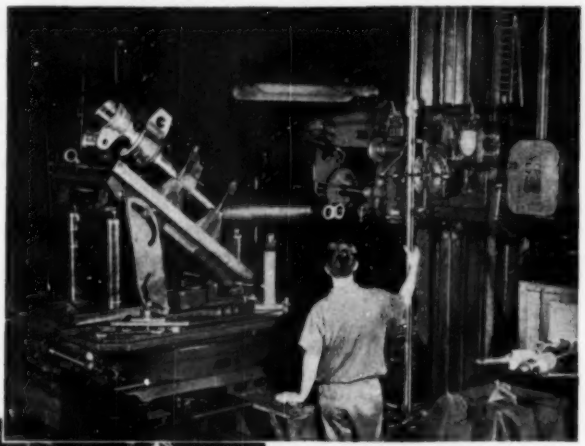
Use Attachments to Reduce Machining Time

Use a simple holding fixture on unusual shaped parts.

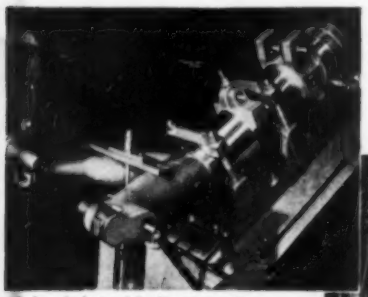
Mill, drill and bore in a single work setting.

Index work on a rotary table for correct alignment.

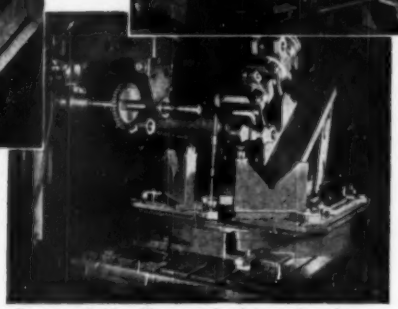
Use standard machines with helpful attachments for difficult operations.



A combination of standard attachments is used on this G&L table type machine to simplify the setup and machining of a landing gear cylinder.



Awkward shape of landing gear cylinder requires ingenuity in setting up for precision machining operations.



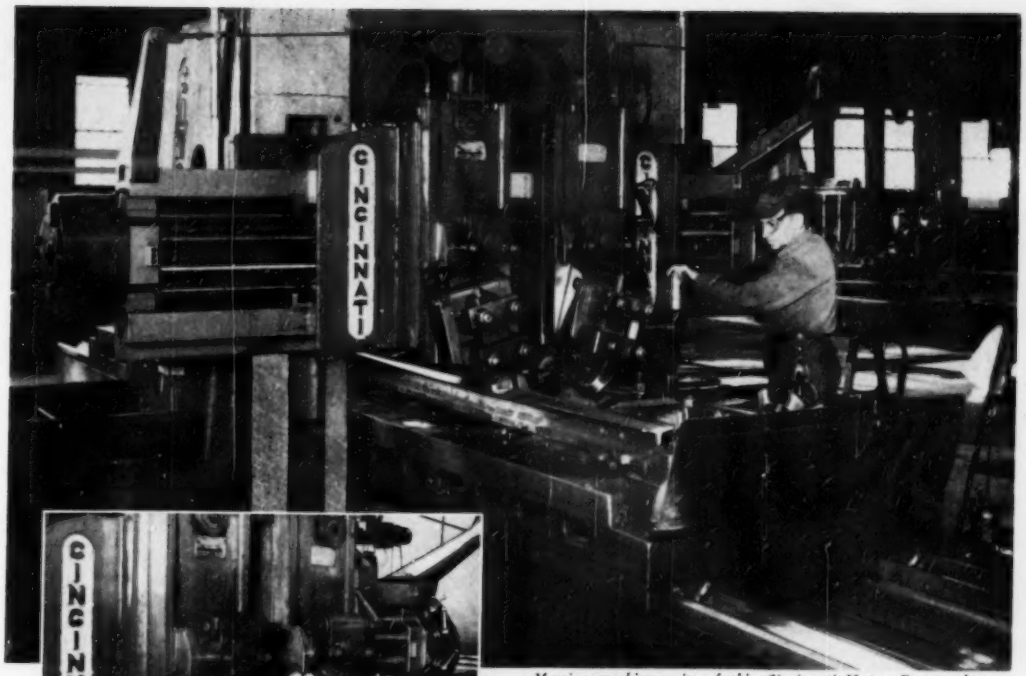
Conventional side milling operation being performed on a G&L horizontal boring machine, equipped with an overarm type arbor support.

There is always a practical and common sense way to set up odd shaped work and perform difficult machining operations on a Giddings & Lewis machine. These graphic illustrations show how an awkward-to-handle aircraft landing gear cylinder is set up and machined on a standard G&L equipped with standard attachments. Few other machines have the open working range, capacity and flexibility required to mount this work and then perform precision boring, drilling and milling operations. Trunnions, trunnion lugs, drag brace lugs and lock lugs are machined before the part is removed from its holding fixture.

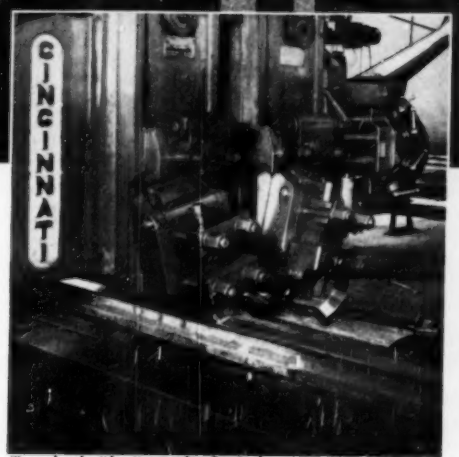
Three standard G&L attachments are used to cut machining time and reduce set-ups on this part. They are: (1) Combination plain and hand feed rotary table that indexes the work with micrometer accuracy and on which the holding fixture is mounted. (2) An overarm arbor support attachment is used to permit milling the slots in the trunnion lugs. The part does not have to be routed to a conventional milling machine when this attachment is used. (3) An angular milling attachment (not shown) mills the flats on the trunnion lugs and drills and bores at right angles to the machine spindle. The work remains in its fixture for these operations. This combination of helpful attachments increases the working range and adds to the flexibility of the Giddings & Lewis Horizontal Boring, Drilling and Milling Machine.

When you are confronted with the problem of machining work of unusual size or shape, it is advantageous to consider standard G&L equipment for your needs. Experienced Giddings & Lewis engineers will gladly point out ways and means of reducing costs on special as well as general run work.

GIDDINGS & LEWIS MACHINE TOOL COMPANY
FOND DU LAC, WISCONSIN, U. S. A.



Massive machine units of this Cincinnati Hypro Frog and Switch Planer makes it possible to take unusually heavy cuts without fear of machine failure or overload.



Two heads "hog" metal off of these 100 lb. high carbon steel rails, using 1/8" to 3/16" feed.

TO REMOVE METAL *accurately* AND *fast*

This Powerful Cincinnati Hypro Planer Meets Heavy-Duty Cutting Demands for Rapidly Machining Railroad Switches, Frogs and Guard Rails

Tremendous power and overall rigidity of this Cincinnati Hypro 42" Frog and Switch Planer easily removes 2" ribbons of steel 3/16" thick in each pass of the machine table. Two massive heads operate simultaneously to plane the flanged bottom of 100 lb. rails which will be used for railroad switches. As soon as the flange is completed, the rails are taper pointed. Machining the switch components in pairs not only reduces floor-to-floor time to 30 minutes, but also matches the rails for greater accuracy in final assembly.

Machine Designed for "Hogging Off" Metal

Use of this Cincinnati Planer is not limited to a single class of work. It is equally effective for numerous jobs where metal must be literally "hogged off".

Each machine unit, including the heads, column, base, cross rail and table, as well as all drive members and gearing is specifically constructed for the heaviest type of service. In addition to railroad work, this same machine is adapted to planing heavy die blocks of all types, forgings and castings, and other equipment components where sheer metal mass is concentrated for strength and rigidity.

You may wish to consider this frog and switch machine—or any other Cincinnati Hypro Planer—for some of your own heavy planing work. Why not consult Cincinnati engineers who will give you experience-proven recommendations without obligation on your part?

THE CINCINNATI PLANER COMPANY

(SUBSIDIARY OF GIDDINGS AND LEWIS MACHINE TOOL COMPANY)

CINCINNATI 9, OHIO, U. S. A.

HYPRO

7 Reasons-

THEY'RE ADAPTABLE!

Pillow blocks available with fixed or floating bearing. (Fixed bearing shown)

THEY CARRY THEIR FULL LOAD!

Self-aligning double row of concave rollers between convex raceways provide full contact, full load capacity, even with shaft deflection or misalignment.

CLEAN OPERATION

Effective seal keeps grease or oil in, dirt out!

FEWER GREASINGS!

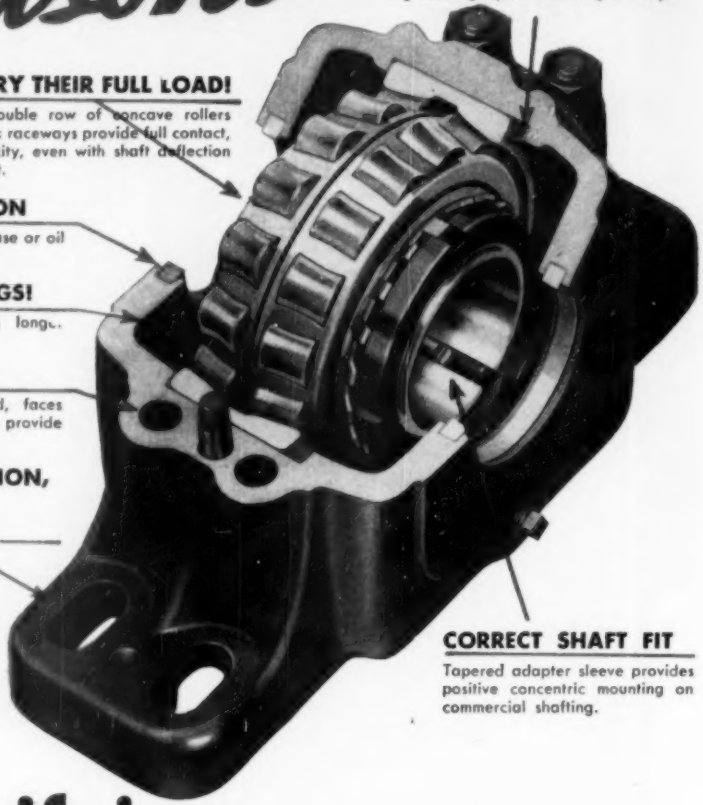
Large reservoir allows longer greasing intervals.

PRECISION FIT

Base and cap doweled, faces accurately ground, to provide leak-proof joint.

EASY INSTALLATION, INSPECTION, DISASSEMBLY

Rugged, two-piece cast housing is simple, with slotted bolt holes for easy mounting.



CORRECT SHAFT FIT

Tapered adapter sleeve provides positive concentric mounting on commercial shafting.

for Specifying

Better and longer service are your prime considerations in choosing such vital equipment as ball and roller bearings. Every feature of Link-Belt bearings is calculated to contribute to their efficiency and endurance. The engineering knowledge of the Link-Belt organization and the unexcelled facilities of a plant devoted entirely to manufacturing precision ball and roller bearings are your assurance of maximum service.

Illustrated above is Series 6800 Roller Bearing Pillow Block, tapered adapter sleeve type; also made in Series 7800 and 7900 press fit type for precision shafting. Other standard models are available in ball and roller bearing types, for various shaft sizes, solid or split housings, open or closed ends, in pillow blocks, cartridge, flanged cartridge, flanged, hanger and takeup blocks. Available from stock at factory branch stores and distributors located throughout the nation and many representatives in other countries of the world.

Complete data in Catalog 2550. Send for your copy.

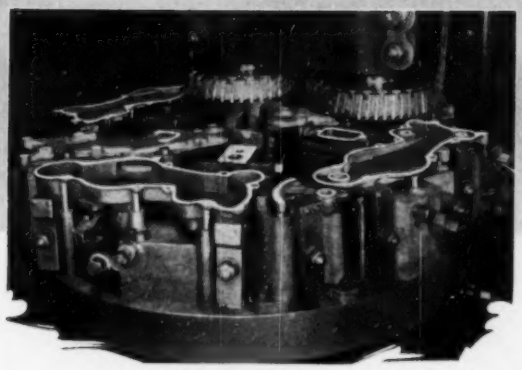
LINK-BELT
Self-Aligning
BALL and ROLLER BEARINGS

THE SYMBOL OF QUALITY — LB — LINK-BELT

LINK-BELT COMPANY 11.733

Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities.

Let one machine with one operator do the work of several

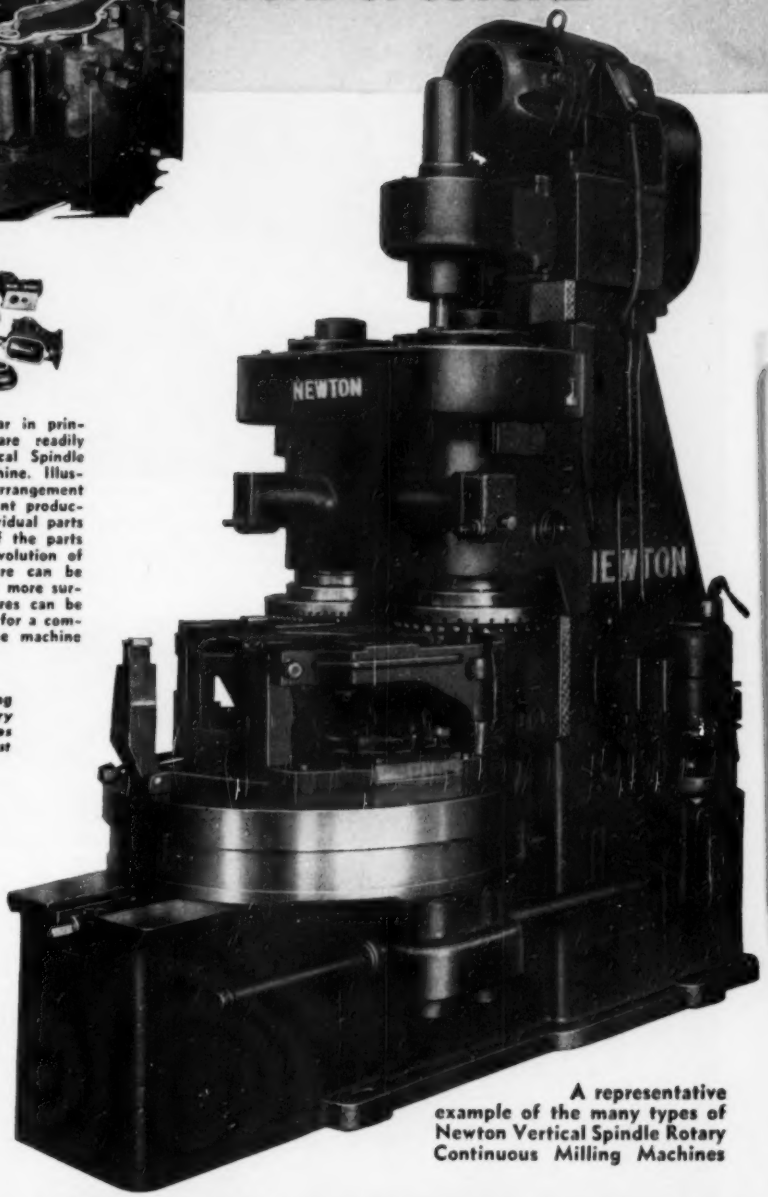


Work-piece arrangements, similar in principle to that shown above, are readily handled on any Newton Vertical Spindle Rotary Continuous Milling Machine. Illustrated here is a fixture arrangement especially adapted to smaller plant production where the quantity of individual parts to be finished is limited. All of the parts shown can be milled at one revolution of the table. Similarly, the fixture can be arranged to accommodate two or more surfaces of the same piece. Fixtures can be arranged to mill all parts needed for a complete assembly, thus keeping the machine in continuous production.

Complete information covering Newton Vertical Spindle Rotary Continuous Milling Machines will be furnished upon request

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES



A representative example of the many types of Newton Vertical Spindle Rotary Continuous Milling Machines

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

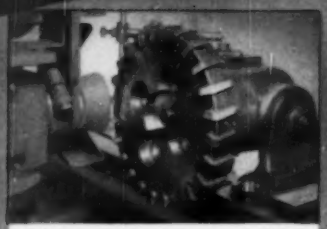
BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

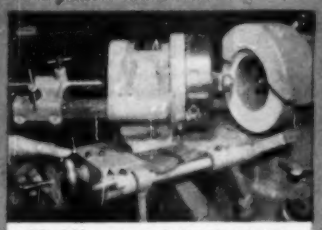
. . . Because—
There's a Cost-Cutting



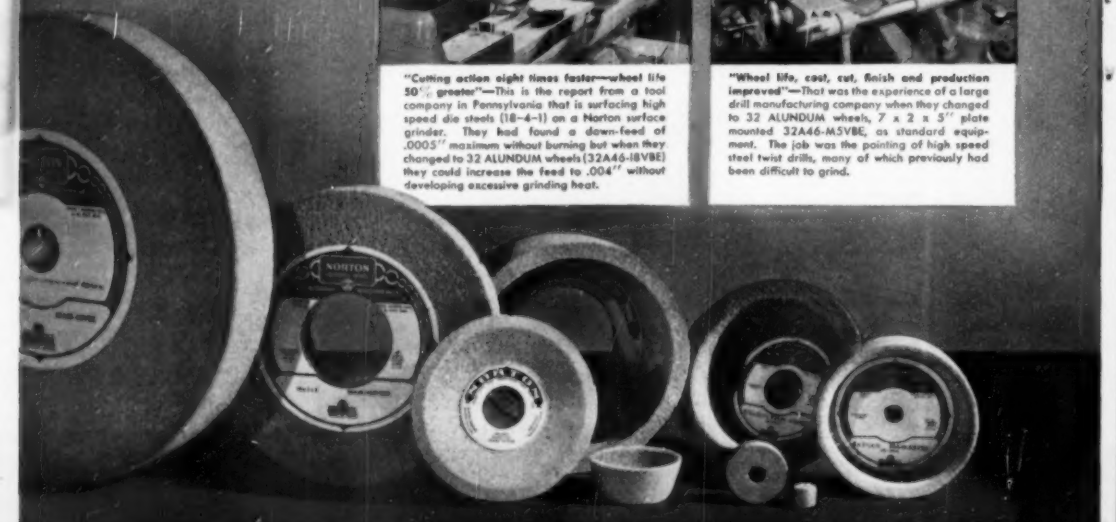
"Faster and cooler cutting than previous wheels"—That is the report of a large mid-western manufacturer on the performance of 5/ 3⅛ x 1⅛ x 1¼" 32 ALUNDUM wheels, tapered cup shape 32A46-K5VBE, in sharpening large multi-tooth cutters. Another cost cutting feature is the fact that it is not necessary to dress the 32 ALUNDUM wheels as frequently as the previous types of wheels.

"Grind better than 1250 sets per wheel"—Wheel life went up considerably for a Massachusetts manufacturer when he changed to 32 ALUNDUM wheels, 12 x 2½ x 7", cup shape 32A46-L5VBE, for grinding the lead and rake angles on thread chasers on his Landis machines. The 32 ALUNDUM wheels give a good commercial finish and show no burn at all.

"Cutting action eight times faster—wheel life 50% greater"—This is the report from a tool company in Pennsylvania that is surfacing high speed die steels (18–4–1) on a Norton surface grinder. They had found a down-feed of .0005" maximum without burning but when they changed to 32 ALUNDUM wheels (32A46-I8VBE) they could increase the feed to .004" without developing excessive grinding heat.



"Wheel life, cost, cut, finish and production improved"—That was the experience of a large drill manufacturing company when they changed to 32 ALUNDUM wheels, 7 x 2 x 5" plate mounted 32A46-M5VBE, as standard equipment. The job was the pointing of high speed steel twist drills, many of which previously had been difficult to grind.



NORTON COMPANY, WORCESTER

Norton Wheel for Every Tool Room Job

32 ALUNDUM Abrasive—

This sensational abrasive—new and exclusively Norton—is making outstanding records everywhere. In thousands of tool rooms they are finding that "32" wheels can make substantial savings on all types of sharpening operations on high speed steels. Its unique crystal structure gives grains that are *sharper*—they penetrate sensitive high speed steels more easily, cutting faster and cooler.

38 ALUNDUM Abrasive—

The original white abrasive, "38" has been a tool room favorite for forty years and is still popular with many tool grinders. It is the recommended abrasive for sharpening jobs where feeds are very light.

57 ALUNDUM Abrasive—

One of the newer Norton abrasives, "57" combines a fast cutting action with great toughness. Thus it is widely used for offhand tool grinding operations. Its slightly lower price also makes it popular for precision sharpening jobs in shops where the first cost of the wheel is given major consideration.

It's really no trick to save money in your tool room if you have the right Norton wheels—wheels carefully selected to meet the exact requirements of each of your tool grinding jobs. Your Norton abrasive engineer or your Norton distributor will be glad to help in that selection job. You'll find a lot of helpful information in the Norton handbook on tool room grinding. Send for a copy—just ask for Form 835-A2.

NORTON
ABRASIVES

You Can Cut Tool Room Costs, too, with the NORBIDE Dressing Stick

Tool rooms are reporting savings up to 50% in dresser costs with NORBIDE Dressing Sticks. Because these sticks are light and easy-to-use, operators keep tool wheels in better condition.

Making better products to make your products better

ARMSTRONG
TOOL HOLDERS...
for the toughest steels!

The "Armstrong System" provides special ARMSTRONG TOOL HOLDERS for ARMALOY (cast alloy) and for ARMIDE (carbide-tipped) cutters. With these modern cutting tools, the toughest and hardest steels are easily machined. Far heavier feeds and the extremely high cutting speeds become practical (300 f.p.m. with ARMALOY cutters; 600 f.p.m. with ARMIDE cutters). Delays for tool re-grinding are reduced to an absolute minimum—edges hold up to 100 times as long.

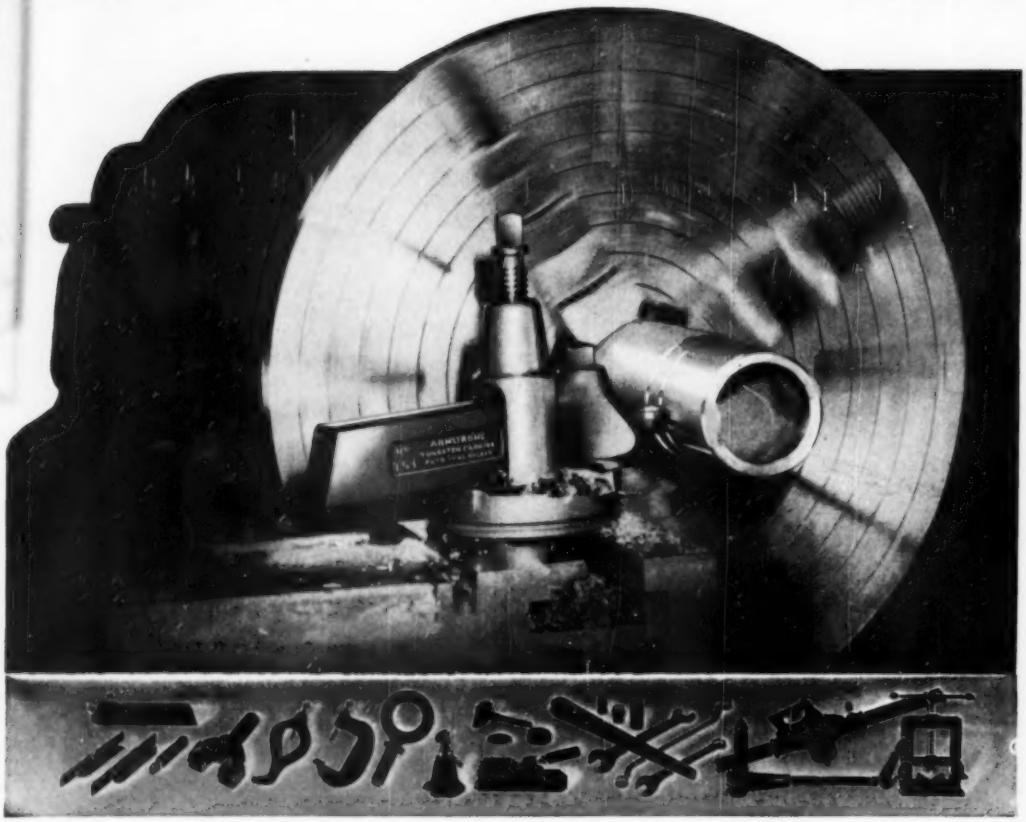
These new tool holders and cutters are stocked by your Local ARMSTRONG industrial distributors.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

WRITE FOR CATALOG

5215 West Armstrong Ave. **Chicago 30, U.S..A**



Hardened Tool Steel Vees

60 ROCKWELL C

protect the carriage ways of

"AMERICAN" PACEMAKER LATHES

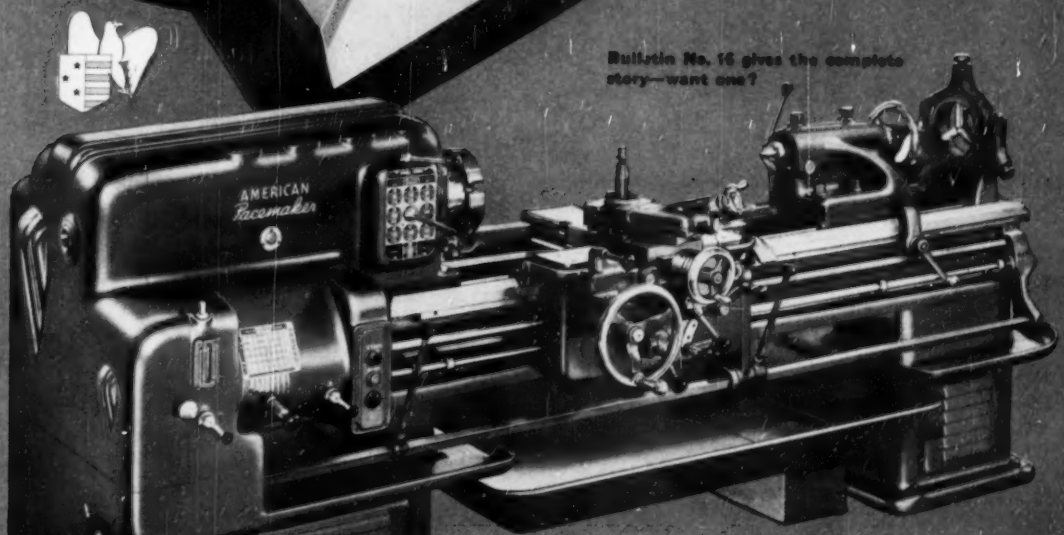
They are standard equipment on all "AMERICAN" Lathes

These hardened vees are made of solid tool steel and ground to gauge tolerances for interchangeability should replacement ever be required.

After hardening, the metallurgical structure is stabilized by cold treatment at minus 108° Fahrenheit to prevent twisting or warping.

This feature is but one of the outstanding advantages offered by the new "AMERICAN" Pacemaker Lathe.

Bulletin No. 16 gives the complete story—want one?



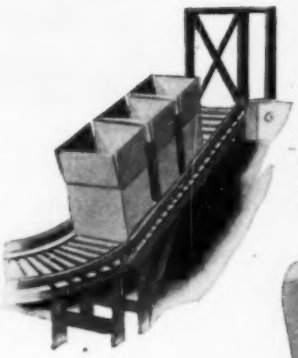
THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

LATHES AND RADIAL DRILLS

BEST BET TO

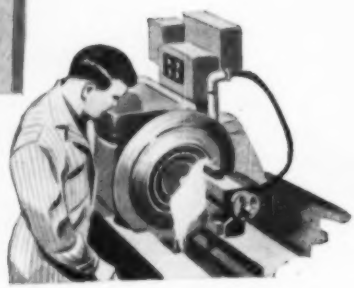
Boosted winding rate 300%

Here's a gain chalked up on the wire rewinders of a Pennsylvania steel company, by installing G-E adjustable-speed drives.



Speeded packaging 55%

Output of a box-sealing machine, newly equipped with adjustable-speed drive, jumped from 38,000 to 60,000 cartons per hour.



Stepped up punching 968%

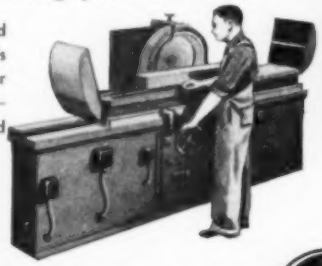
A feat performed on a large punch press, hiking output from 78 to 800 parts per minute.

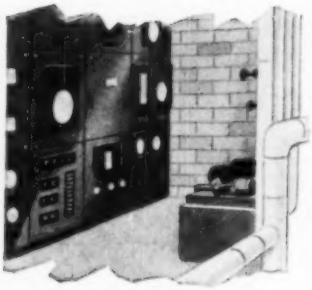
Raised turning output 66%

This was worked out by specifying adjustable-speed drive on an automatic lathe.

Increased grinding production 40%

This gain was achieved on a Buffalo company's face and knife grinder with—you guessed it—an adjustable-speed drive.





Speeded proportioning

A chemical manufacturer found it possible to go from batch to continuous processing in the production of phthalic anhydride by using adjustable-speed drives.

GENERAL ELECTRIC

751-1

BOOST OUTPUT

General Electric adjustable-speed drives can increase the output of your machines—make them more accurate, more versatile

Extra production you never expected may be ready to roll from your driven machines. Call it bonus production, since you get it by using improved speed control, and not by adding new machines. You can expect even more than boosted output from properly applied adjustable speed—it's a single-handed help in improving product quality, minimizing waste of time and materials, and cutting down on rejects.

Adjustable-speed drives have been around for years. But General Electric has brought them to a new high in versatility and power to work production miracles. Now you can buy G-E drives precision-engineered to your machines, at mass-production prices. Now you can choose from a complete line of General Electric Drives—packaged drives providing utmost flexibility. G-E drives offer plants that can use better speed control a quick way to halt the squeeze on profits.

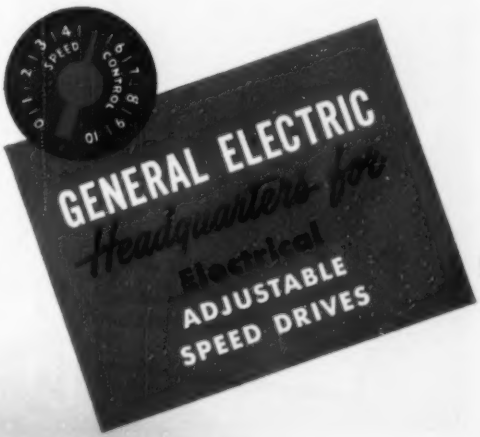
TO UNCOVER OPPORTUNITIES for saving through the application of adjustable speed in *your* plant, General Electric offers this help:

First, the assistance of specially trained sales engineers who bring you the benefits of experience gained in applying adjustable speed to practically every kind of machine in practically every industry. Pick up your phone now and call your nearest G-E field office. You'll find the telephone number listed in your directory.

Second, a comprehensive, carefully illustrated book on the *whole* subject of adjustable speed. It's written from management's viewpoint, but backed up with all the facts an engineer needs. Write for your copy. *Apparatus Department, Sec. 751-1, General Electric Co npany, Schenectady 5, N. Y.*

New G-E Booklet on Adjustable-speed Drives

Your copy of the new 24-page adjustable-speed booklet is ready. Please write for Bulletin GEA-5334 on your business letterhead.



PRECISION
Photos courtesy The Boeing Airplane Company
IT takes a lot of big tooling — precision tooling — to build the Boeing Stratojet Precision Bomber, and the PRATT & WHITNEY 4E JIG BORER helps to provide it. With this big new machine, Boeing locates, bores and checks heavy work for the B-47s to .0002" accuracy . . . attains maximum productivity and economy from the 4E's new features which include push button control for all motions . . . electronically controlled milling feeds infinitely variable from 1" to 15" per minute . . . electrolimit spacing. These, and other advanced design features, provide operating speed and accuracy in this 15 ton machine equal to that obtained with smaller, lighter equipment. Table size is 36" x 72" (machine can be furnished with several column heights and with several types of rotary tables). Newly published Bulletin tells more about this most modern of Jig Borers; write for your copy.
PRATT & WHITNEY
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT
4E JIG BORER

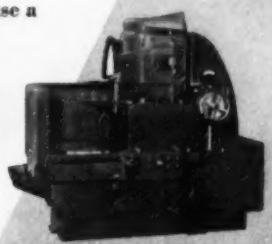
Housing Shortage? ... *Put them on a Blanchard*

A manufacturer was getting 1 to 2 gear case housings (right) per hour by a former method — now a Blanchard No. 18 is grinding the joint surfaces of 8 to 9 pieces per hour. Up to 3/16″ of cast iron is removed per piece. 3 pieces are produced in a single operation to required tolerance.

Thirty transmission housings per hour (left) are finish ground on a Blanchard No. 11, removing .010″ from previously machined castings. They are held flat to .001″ and to ±.002″ for size. A special Blanchard-designed holding fixture, actuated by a single wrench motion, helps produce these housings in such short time.

There will be no housing shortage in your plant if you use a Blanchard Surface Grinder—may we grind your samples to prove our point?

Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."



NO. 18 BLANCHARD SURFACE GRINDER

PUT IT ON THE BLANCHARD **THE BLANCHARD MACHINE COMPANY**

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

Saves Time and Money on any Metal or any Automatic..

SINCLAIR SUPER WILKUT

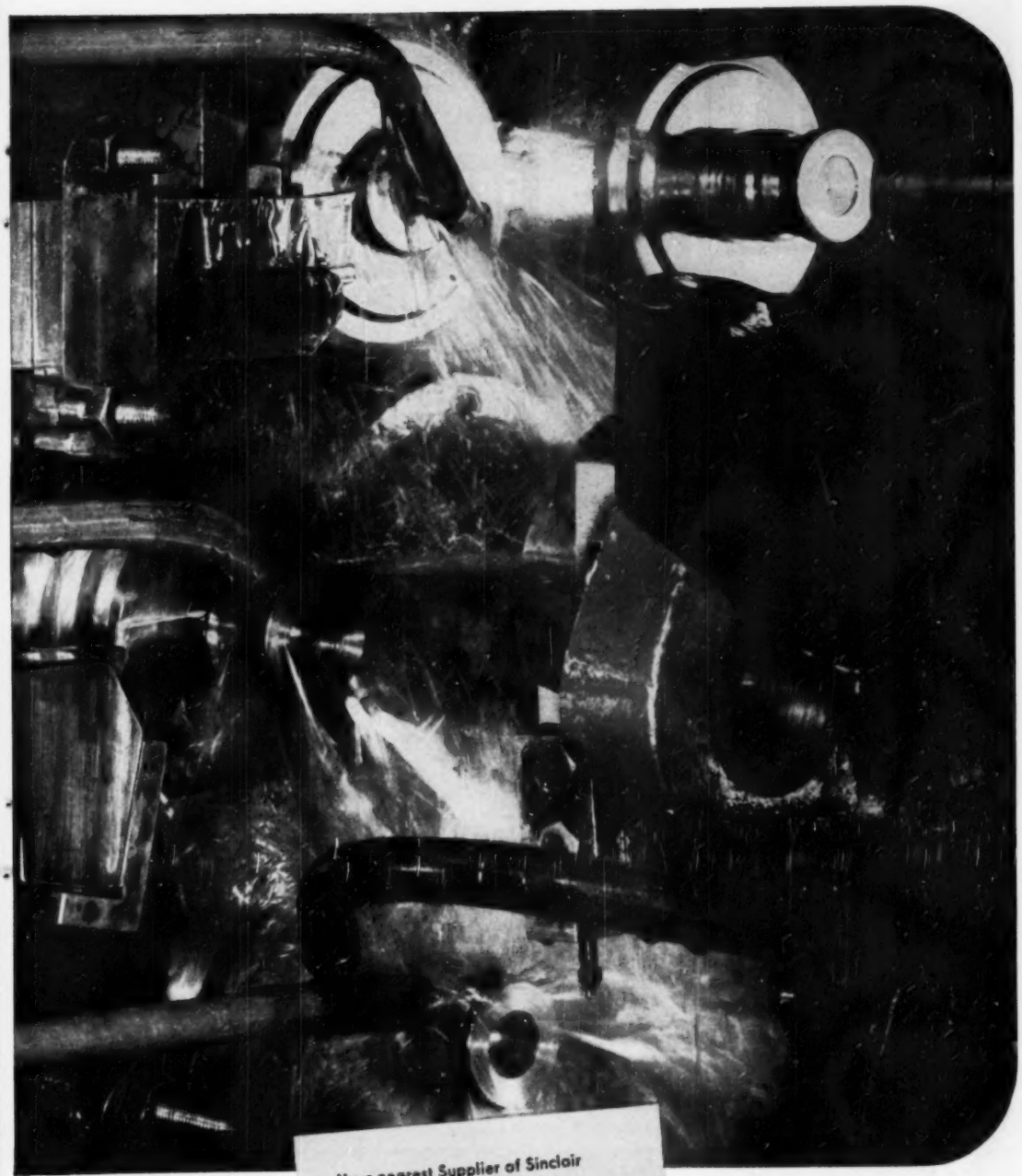
You don't have to change oil every time the metal on the job is changed! Here's a sulphurized cutting oil that can be used effectively on *any* metal — ferrous and non-ferrous, including difficult alloys. And it can be used on *any* type of screw machine.

Sinclair Super Wilkut, besides being versatile, is also highly efficient. It carries heat away quickly, keeping tool and work cooler—often making practicable higher cutting speeds. It helps produce accurate finish by preventing pick-up and keeping tools sharp. Super Wilkut has been used successfully with cemented carbide tools where recommended water emulsion proved unsatisfactory.

***Note:* Many operators even use Super Wilkut for lubricating their machines and report highly satisfactory results.**

Try Super Wilkut in one of your screw machines. Prove to yourself that it can save you time and money.

SINCLAIR INDUSTRIAL



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Kaukauna universal DRILLING and TAPPING MACHINE

MODEL 140-U Universal Portable Drilling and Tapping Machine for Heavy-Duty Service.

A truly universal machine for heavy-duty drilling, tapping, boring and spot facing operations. Quickly adjusted at any angle—or compound angle—in any direction—at any location in the shop. Completely self-contained. Completely portable and readily moved to the toughest, most difficult, hard-to-get-at jobs.

extreme flexibility

- √ Column, rail and headstock move under power as a unit on the machine runway.
- √ These machine elements rotate on the column base duplicating the arm movement of a radial drilling machine.
- √ Vertical power movement of rail and headstock unit on column for high reach.
- √ Horizontal power traverse to headstock on rails at any angle to runway travel.
- √ Power swiveling of the headstock on trunnion in any plane through 360°.
- √ Power swiveling of trunnion on rails in vertical plane through 180° positions spindle quickly.
- √ Power and hand traverse to the spindle.

completely portable

Easily moved by overhead crane to the job. Does not require precision leveling. Eliminates the movement of large, heavy work to the machine. Reduces set-up time, labor and production costs.

Send for complete information on this new, heavy-duty machine which simplifies set-up and reduces tooling costs on production and job shop work. Details and specifications gladly supplied upon request.

The Complete Kaukauna Line includes:

MODEL 125-U	Universal Portable or Fixed Location Drilling and Tapping Machine for Medium-Duty Service with 2½" Spindle, No. 4 Morse Taper, 5 H.P. Drive.
MODEL 125-HR	Portable or Fixed Location Drilling and Tapping Machine for Medium-Duty Horizontal Work with 2½" Spindle, No. 4 Morse Taper, 5 H.P. Drive.
MODEL 140-U	Universal Portable or Fixed Location Drilling and Tapping Machine for Heavy-Duty Service with 4" Spindle, No. 5 or 6 Morse Taper, 10 to 20 H.P. Drive.
MODEL 140-HR	Portable or Fixed Location Drilling and Tapping Machine for Heavy-Duty Horizontal Work with 4" Spindle, No. 5 or 6 Morse Taper, 10 to 20 H.P. Drive.
MODEL 1030	Horizontal Portable or Fixed Location Drilling and Tapping Machine with Tilting Head for Medium-Duty Service with 3" Spindle, No. 5 Morse Taper, 7½ H.P. Drive.
MODEL 1040	Horizontal Portable or Fixed Location Drilling and Tapping Machine with Tilting Head for Heavy-Duty Service with 4" Spindle, No. 5 or 6 Morse Taper, 10 to 20 H.P. Drive.

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NOW, GET TIME-SAVING MONO-LEVER CONTROL ON NEW 3hp MILLING MACHINES

You asked for them — here's one in action — a new 3hp Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle. Savings on this simple form-milling job amounted to 28%!

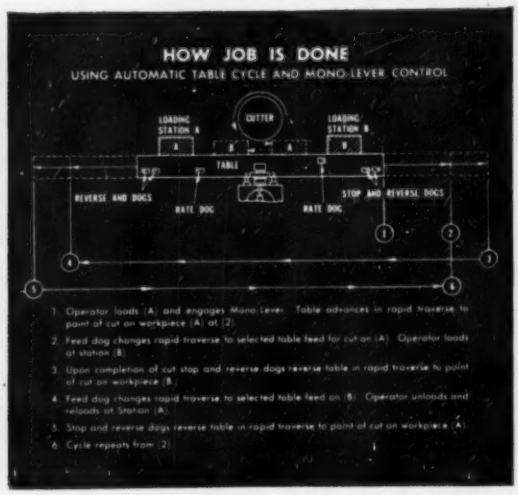
HOW JOB IS DONE
USING AUTOMATIC TABLE CYCLE AND MONO-LEVER CONTROL
LOADING STATION A
CUTTER
LOADING STATION B
TABLE
REVERSE AND DOGS
RATE DOG
RATE DOG
STOP AND REVERSE DOGS
1. Operator loads (A) and engages Mono-Lever. Table advances in rapid traverse to point of cut on workpiece (A) at (2).
2. Feed dog changes rapid traverse to selected table feed for cut on (A). Operator loads at station (B).
3. Upon completion of cut stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (B).
4. Feed dog changes rapid traverse to selected table feed on (B). Operator unloads and reloads at Station (A).
5. Stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (A).
6. Cycle repeats from (2).

Diagram shows how operator set up table for automatic reciprocal milling operation. He engaged the Mono-Lever once for entire run. Machine required no further attention other than loading workpieces.

COMPARE

Production by old method.

28% Production gain using a Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle.

HERE'S GRAPHIC PROOF OF SAVINGS RESULTS

16% 16%-49% 49%-96%

1. The minimum over-all savings reported from any job when done on a Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle.
2. The *majority* of over-all savings from jobs done on these machines fall here.
3. Under favorable conditions, several jobs done on these machines have shown savings like this!

YES, you can now get the proven cost-cutting benefits of Mono-Lever Control and Automatic Table cycle on 4 new 3hp Kearney & Trecker knee-type milling machines.

Exhaustive job tests have shown that savings made possible by Mono-Lever Control and Automatic Table Cycle on larger machines — *are equally available on these new 3hp machines.* That means savings to you of *16% to 96% on most milling operations!*

Contact our nearest representative today. Get the facts on how new Kearney & Trecker Milling Machines with Mono-Lever Control and Automatic Table Cycle return new savings to you. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

all new all the way thru

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STRONGBOX MAGNET COIL – Coil is locked in a tough block of plastic.

NEW ARC HOOD – Molded, burn-resistant arc hood snuffs arc immediately.

NEW CONTACTS – Large silver contacts with plenty of contact pressure give long life. Convertible from normally open to normally closed in size one and smaller – without additional parts.

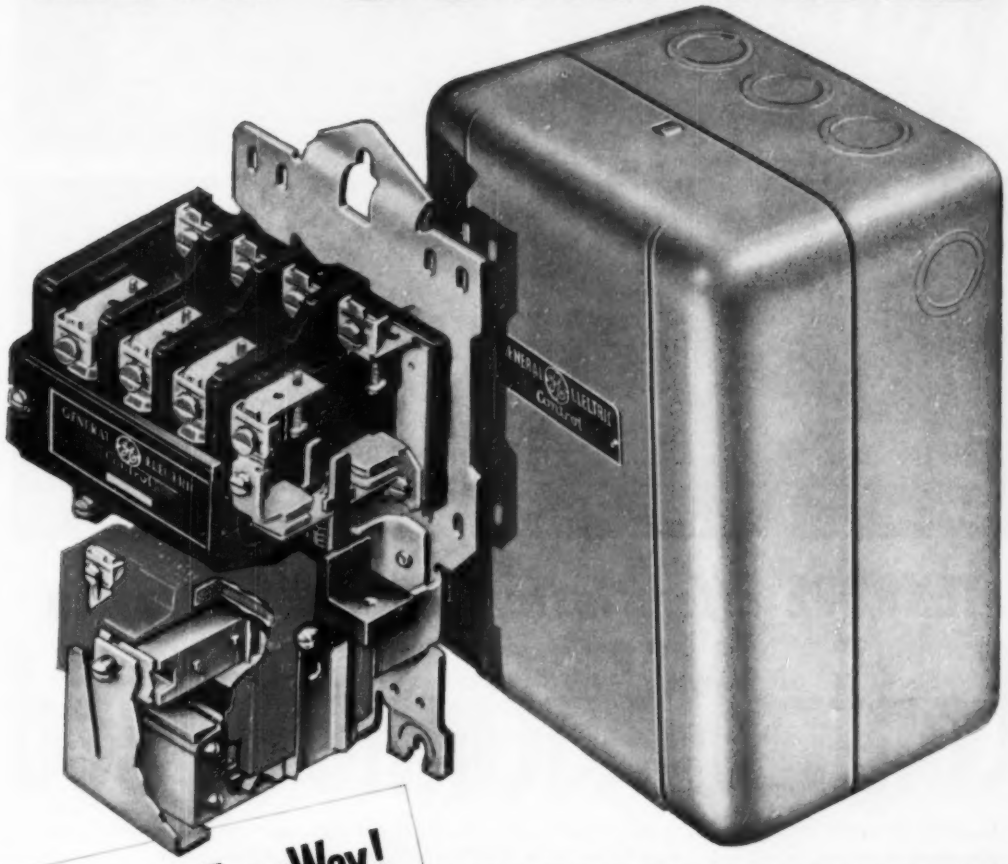
NEW MAGNET – Quick direct action, large striking surface.

EASY TO INSTALL – EASY TO MAINTAIN – See how easy it is to get at the ALL-NEW General Electric starter. Note, too, that it's built to take the punishment of day-in, day-out use with a minimum of maintenance. Check the wiring space inside the case. Check the terminal clamps that make installation fast. Check the ease with which controls can be inspected.

DESIGNED FOR FAST ACTION – BUILT FOR LONG LIFE – From the tough STRONGBOX magnet coil to the high strength arc hood, all parts of the new General Electric Motor Starter are built to last. In the revolutionary G-E design, the plastic coil enclosure also serves to guide the armature. For fast, positive action the tough plastic block is impregnated with a permanent lubricant – molybdenum sulphide. Channel-reinforced magnet guides slide smoothly for quick action at all times. Bimetallic thermal relays give swift protection.

GENERAL ELECTRIC

and COMPARE



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Look inside. Make the screwdriver comparison test. Inspect the many new features, and we're sure you'll be enthusiastic. Just fill in the coupon at the right and we'll send you the starter immediately. Or, if you prefer, we'll be glad to send you the new, free, tell-all booklet "Look Inside and Compare" that gives more detailed information.

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Section J676-281, Schenectady 5, N. Y.

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Motor Horsepower Rating (check one)

☐ 3 ☐ 5 Horsepower at 220 Volts
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Approx. Motor Speed ☐ 1800 RPM ☐ 3600 RPM ☐ 1200 RPM

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Address _____

City _____ **Zone** _____ **State** _____

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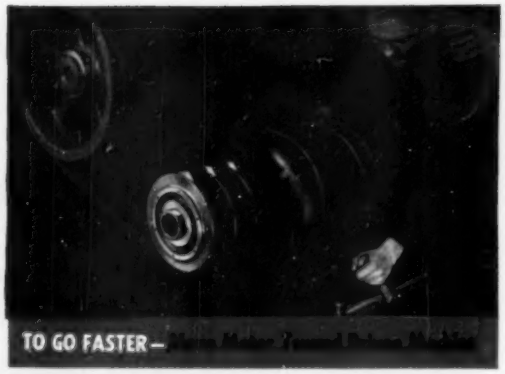
AUTOMATIC
SHEAVE



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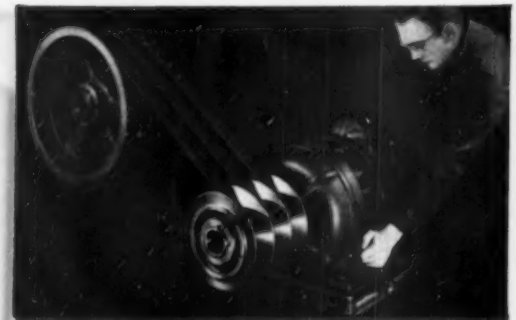
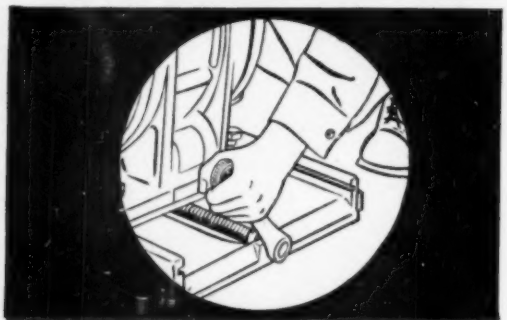


TO GO SLOWER—



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Control Machine Speed

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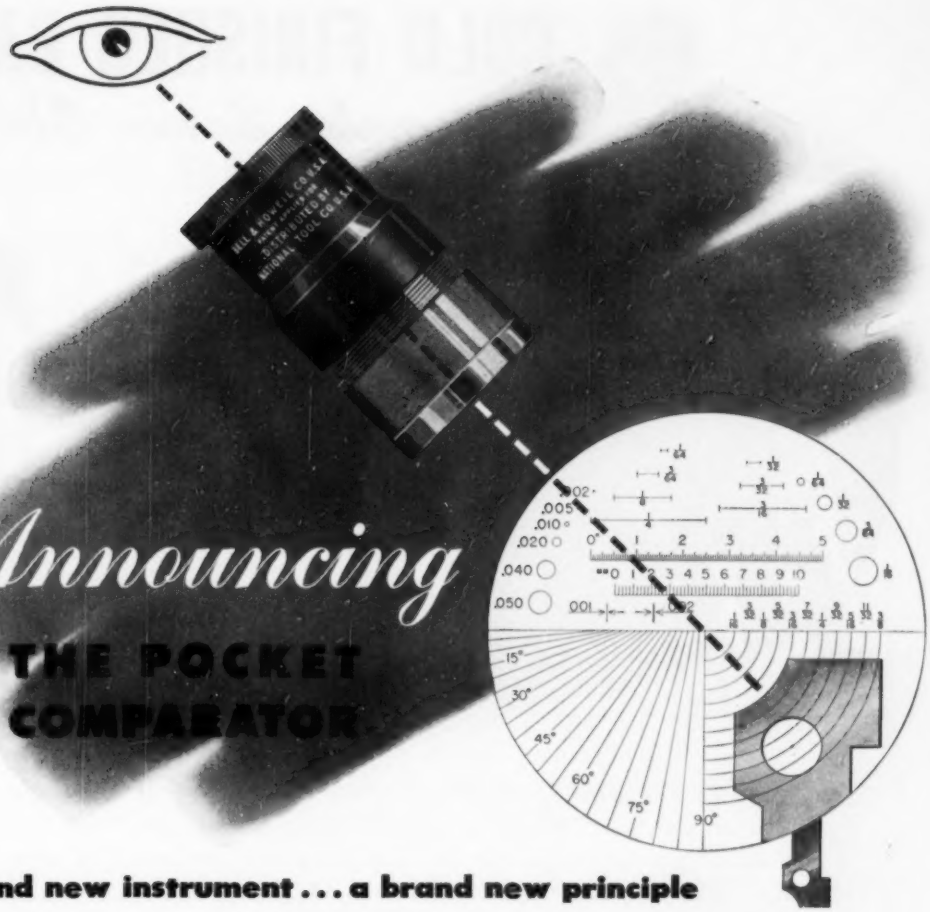

A brand new instrument . . . a brand new principle

to save you time and money inspecting small parts

HERE'S WHAT IT IS

The Pocket Comparator is a precision optical measuring instrument for the inspection of small parts. Measurements are accomplished through a combination of a high-precision six-power triplet aplanatic type magnifying lens and an engraved pattern or reticle. The reticle is calibrated for measuring lengths, widths, circles, radii and angles. Body of the Pocket Comparator is of machined aluminum with black anodized protective finish.

HERE'S WHAT IT DOES

TOOL ROOM USE:

Checks forms and dimensions of punches, dies, gauges, cutting tools.

Checks sizes and forms of templates, layouts, all kinds of cutting edges, etc.

PRODUCTION CHECKING:

Checks radii, angles, chamfers, threads, small holes, lineal, radial and tangent dimensions—often eliminates need for more expensive and elaborate measuring devices.

GENERAL USE:

For metallurgists and chemists—general laboratory work.

For textile and paper industries—for checking grades and flaws.

For die casting and plastic molding—general inspection.

For instrument makers, jewelers, etc., for checking size, grade, form, flaws, etc.

For printer, engravers and artists and general use in home workshops.

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Precision Tools

☐ Send me Free Descriptive Folder

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YOUNGSTOWN Cold Finished Carbon and Alloy Steel Bars are now being produced in a wide range of sizes and shapes, supplied either in coils or straight lengths.

Drawn to meet standard specifications, these bars have the characteristics that make them ideal for high-speed screw machine operations--uniformity of composition, toughness and strength, close tolerances in dimension, and smoothness and brightness of finish.

You'll find a Youngstown bar stock to meet almost any requirements. Tell our representative what you want and we will make every effort to serve you at once.

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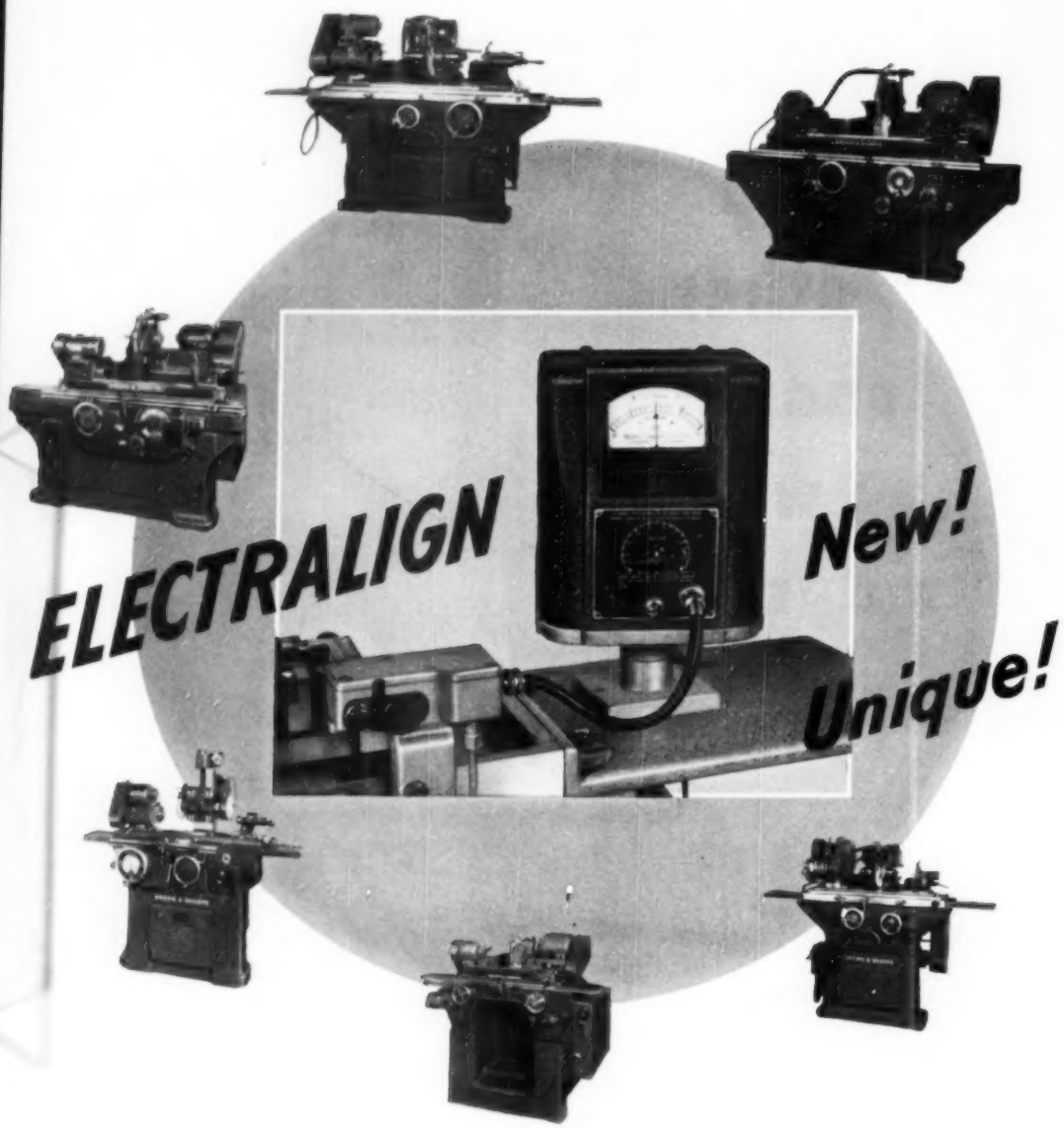
BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.



NOW AVAILABLE WITH THESE BROWN & SHARPE MACHINES

- **Nos. 1, 2, 3 and 4 Universal**
- **No. 5 Plain** (3″ x 12″ and 3″ x 18″)
- **No. 10 Plain** (6″ x 18″ and 10″ x 18″)
- **No. 12 Plain** (6″ x 30″ and 10″ x 30″)
- **No. 20 Plain** (10″ x 18″)
- **No. 22 Plain** (10″ x 36″)
- **No. 23 Plain** (10″ x 48″)
- **No. 13 Universal and Tool**

BROWN &

NOW—a revolutionary development to simplify grinding set-ups!

ELECTRONIC ALIGNMENT OF SWIVEL TABLE on Cylindrical Grinding Machines

With an Electralign-equipped machine, the hardest part of grinding straight work and exact tapers is made easy and positive. This exclusive device permits the operator to align a swivel table fast and accurately after only one preliminary grind. It also permits correction during the grinding operation.

. Electralign makes use of sensitive electrical resistance wire strain gages to detect swivel table movements and an electronic amplifier to magnify these movements. Deflections are direct reading . . . no interpolation or transposition of figures needed.

AVOIDS COSTLY CUT-AND-TRY OPERATIONS IN GRINDING STRAIGHT WORK AND EXACT TAPERS

With Electralign, there is no need of regrinding several test pieces in order to obtain proper adjustment. Displacements of as little as .0001″ are easily detected . . . and are amplified to well spaced graduations on the indicating scale. Only one setting is necessary for the correction.

PROVIDES CONTINUOUS VISUAL CHECK

The Electralign acts as a "watchdog" . . . as grinding progresses, any deviation of instrument needle from zero warns operator that some jar or vibration has changed the setting of swivel table. It does much to eliminate costly spoiled work.

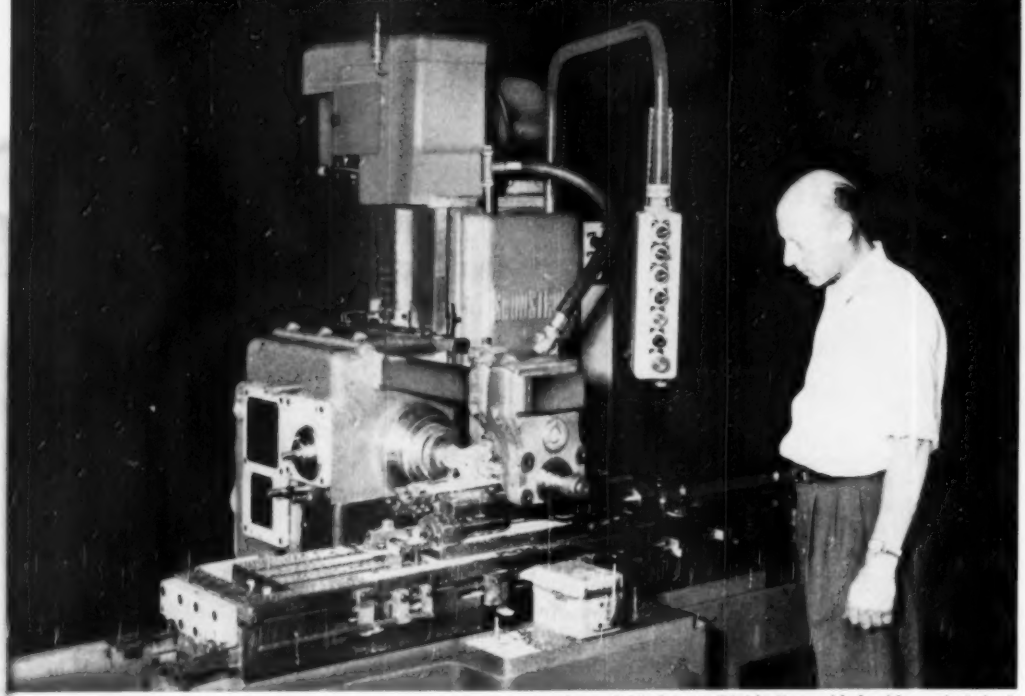
MANY COST-CUTTING ADVANTAGES

With Electralign, you can handle *more* straight and taper grinding . . . faster. You can reduce rejects . . . perhaps eliminate them altogether. You can remove the tension and pressure that usually goes with precision work. New operators can be trained much easier and faster. The extreme simplicity and reliability in operation of this arrangement makes it very practical for shop use. Write for complete details. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

ALSO AVAILABLE: Brown & Sharpe Electralign-Comparator Selector allows use of comparator for external or internal measurements of finished work. Only one amplifier needed for electronic alignment plus measurement of work.

SHARPE B·S

How Combined Automatic Vertical and Horizontal Feed Cycles Cut Milling Costs



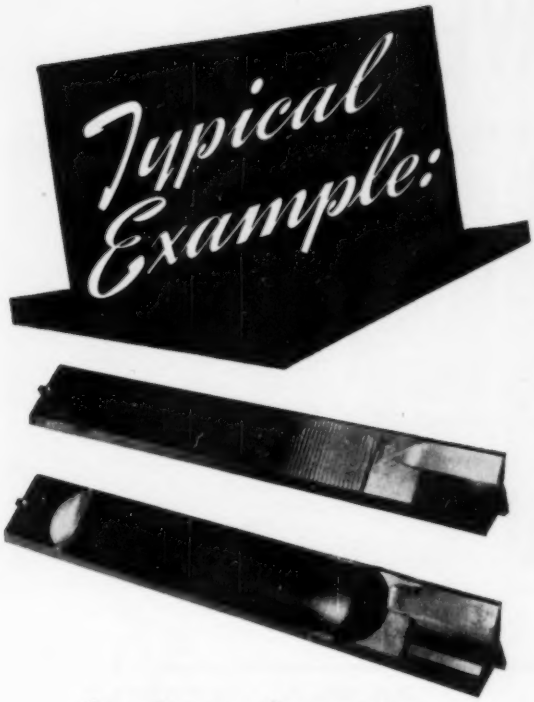
Sundstrand Model 22 Rigidmil provided with vertical feed attachment for milling turbine blades.

Quick Set-Up Cycle Combinations Handle Wide Range of Parts and Cuts

This manufacturer handles many different sizes of parts on his Sundstrand Model 22 Rigidmil. He reports an average saving of 47% per piece over the former method. In addition, finish has been improved and cutter life increased.

Although it is a Standard Rigidmil, it has been equipped with a standard vertical feed attachment, which provides up to 4 intermittent cuts as shown in cycle diagrams on opposite page. The machine can easily be set-up to cycle for roughing cut and recycle (automatically) for a finish cut at different depths. The machine is equipped with a mechanical feed box, which provides 100 to 1 feed ratio. Spindle speed ratio is 80 to 1.

RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

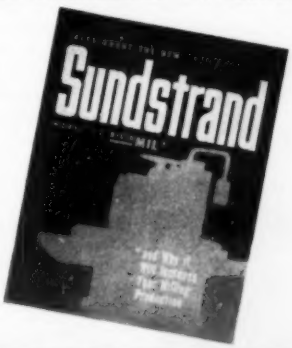


Savings Average 47% Per Piece

Shown above is a turbine blade as it comes to the Sundstrand Model 22 Rigidmil (above) and after milling operation has been performed. An almost endless variety of these blades are processed over this machine. Types of cuts include concave and convex milling. Rough and finish cuts are performed on some pieces *within the same machine cycle.* Possible cycle combinations are shown at right.

Get These Facts

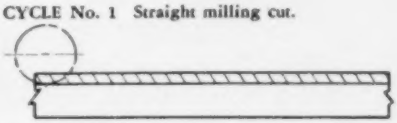
Complete information on the Sundstrand Model 22 Rigidmil is included in this 8 page folder. Write for your copy today. Ask for bulletin No. 192



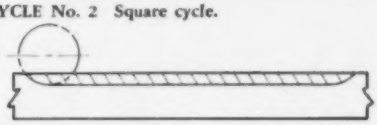
Possible Cycle Combinations

Combining table cycles with vertical feed cycles of spindle head makes it possible to obtain a variety of combinations to handle a wide range of parts and cuts. The first five cycles illustrated below are used on the installation described at left. The 6th cycle is available when machine is equipped for four different depths of feed to the spindle head.

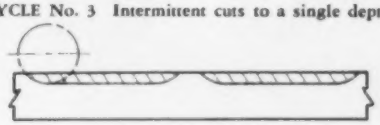
CYCLE No. 1 Straight milling cut.



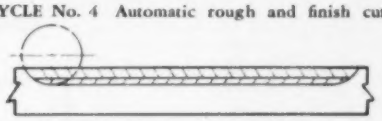
CYCLE No. 2 Square cycle.



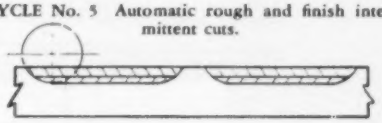
CYCLE No. 3 Intermittent cuts to a single depth.



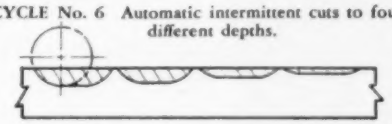
CYCLE No. 4 Automatic rough and finish cuts.



CYCLE No. 5 Automatic rough and finish intermittent cuts.



CYCLE No. 6 Automatic intermittent cuts to four different depths.



NOTE: Cycles 1, 2 and 3 can be obtained with standard vertical feed attachment and table control dogs. Cycles 4, 5 and 6 require extra electrical equipment and control dogs.

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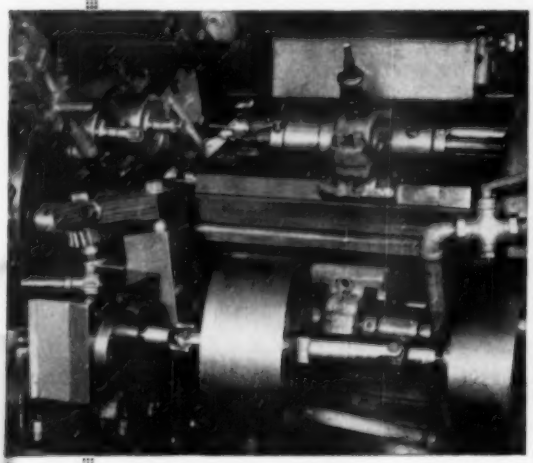
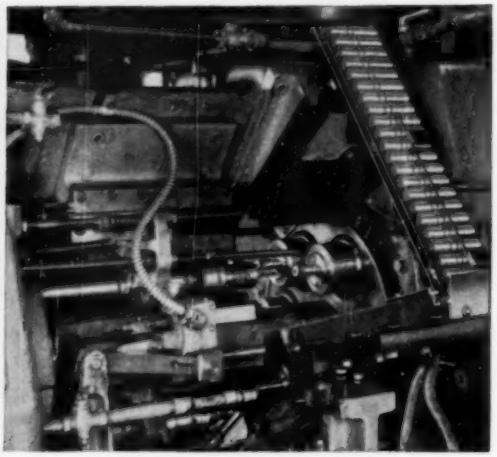
DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

HOW TO SAVE ON SECOND OPERATION JOBS



Front tooling zone, Acme-Gridley bar automatic with special hobbing attachment for machining ratchet shafts.



Rear tooling zone, Acme-Gridley bar automatic with special magazine loader used in machining ratchet shafts.

JOB FACTS

Part—Ratchet Shaft 15/16" diameter x 3 7/8" long
Material—SAE 1112
Operations—6, including hob 12 serrations
Machine—Acme-Gridley 1 1/4" RA-6 spindle bar automatic with magazine loading
Machining Time—10.7 seconds per piece

Second operations can sop up a lot of production dollars—unless you handle them right.

The *right* way—the timesaving, money-saving way, is to put them on an Acme-Gridley. Its greater versatility permits the liberal use of independent, power-driven auxiliaries—that combine operations, reduce handling, and cut machine overhead.

Take the ratchet shaft job illustrated, for example. Instead of transferring the part to a hobbing machine after the second operation drilling and tapping has been performed, the twelve serrations are machined by a hobbing attachment. Result: one less machine, one less unloading and reloading operation. And magazine loading cuts man-hours and production time still farther.

Wide, open tooling zones, close-coupled camming, rigid construction and plenty of power pay off in more good pieces in the pan every time. These are the practical, dollar-saving kinds of results you can expect from every Acme-Gridley. May we give you more facts, stated specifically in terms of your own needs? No obligation, of course.

The NATIONAL ACME CO.

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Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Thread Rolling Machines Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Counters • Solenoids Centrifuges • Contract Manufacturing

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for lowering metal cutting costs

■ When you see how CIMCOOL° lowers metal cutting costs in your plant, you'll heartily agree it deserves a first place award. This revolutionary cutting fluid—this **chemical emulsion**—saves you money in three important ways:

■ CIMCOOL INCREASES TOOL LIFE (and thus reduces down time) because of its **chemical lubricity.**

■ FASTER SPEEDS are possible because Cimcool cools faster, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.

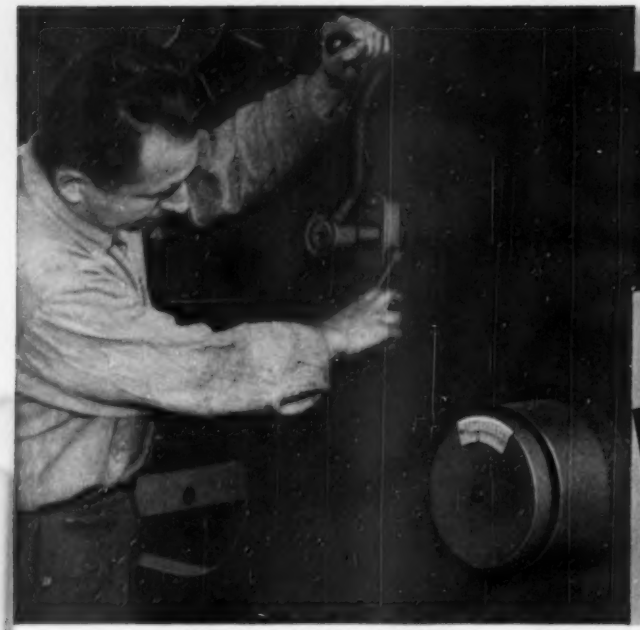
■ CIMCOOL COSTS LESS than old-fashioned cutting fluids because it lasts longer. It cuts cost of cleaning and changing. It virtually eliminates rancidity and foul odors. And because of its low surface tension and low adhesion to work and chips, there is practically no carry off.

■ We sincerely believe one test run will convince you. And we're prepared to provide a demonstration in one of your own machines. Just write us and we'll have one of our Cincinnati Milling-trained machinists call on you. Or if you prefer, write for our free booklet "CIMCOOL Gives the Answers." Address, Sales Manager, CIMCOOL Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

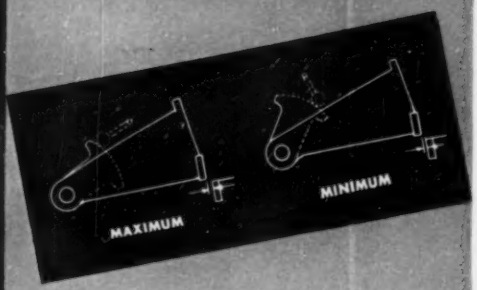
°Trade Mark Reg. U.S. Pat. Off.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for 85%
OF ALL METAL CUTTING JOBS



MICRO-SPEED *acclaimed*



KNIVES REMAIN SHARPER LONGER BECAUSE OF MICRO-SPEED

From coast to coast Steelweld Shear users are acclaiming Steelweld's MICRO-SPEED knife adjustment. There's nothing like it available on any other shear—at any price. It's the greatest development in shear design made in decades.

As every shear user knows, there is a direct relation between the thickness of plate cut and the clearance between knives for most satisfactory results. But heretofore, because of tedious time-consuming work required to change knife clearance, most shear operators seldom adjusted the clearance unless there was a great variation in the thickness of plates being cut. Despite the advantages resulting, they could not afford the time required to adjust the knives to proper clearance.

Steelweld's MICRO-SPEED makes knife adjustment fast and easy. Merely turn a crank and watch a dial. That's all there is to it. In a jiffy the indicator is on the proper figure and the machine is ready to go. No bolts to loosen! No bed to move! No feeler gauges required! The large easily-read dial indicates the clearance between knives in thousandths of an inch and also shows the plate thickness that may be cut with any knife setting.

Because of simple MICRO-SPEED knife adjustment, every cut made on Steelweld Shears is the best possible cut — straight, smooth, accurate. And of importance, KNIVES REMAIN SHARPER, LONGER.

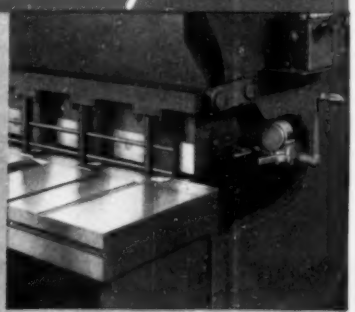
A FEW OF MANY OTHER *Production Speeding* FEATURES

LIFT-UP BACK GAUGE

Lift-up back gauge can be raised out of way to allow long sheets to pass through by easy movement of horizontal bar. No time need be spent detaching or removing back gauge. Standard feature on ¼ inch capacity shears and larger.

FATIGUE-REDUCING FOOT CONTROL

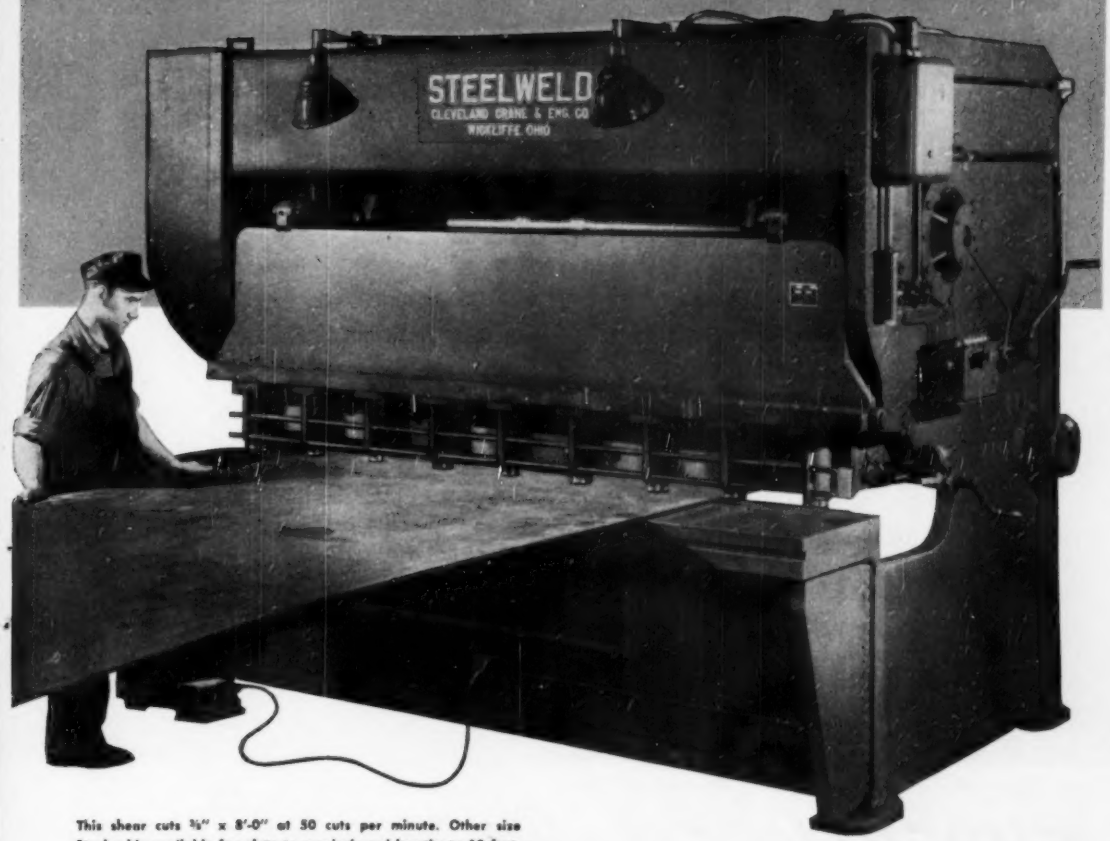
Convenient electric foot-switch operation is standard for all Steelweld Pivoted-Blade Shears. The switch can be moved around floor to wherever handiest. Eliminates tiresome leg lifting ordinarily required.



STEP-SAVING GAUGE ADJUSTMENT

Steelweld design eliminates need of many steps around machine to adjust hand-operated back gauge at rear. Adjustment crank is quickly reached at right end near front. When required, power-driven gauges can be furnished.

KNIFE ADJUSTMENT *by* STEELWELD SHEAR USERS



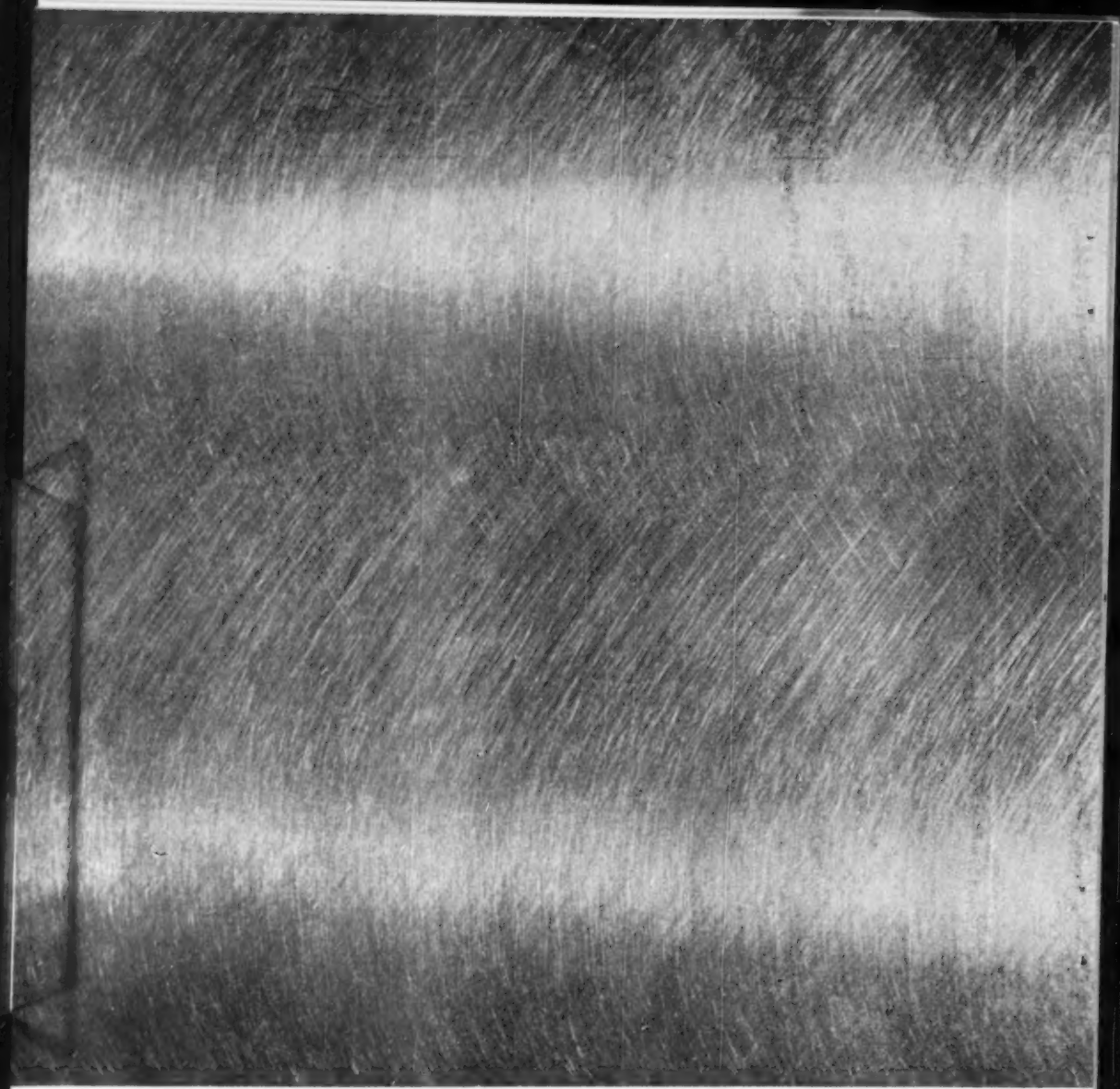
This shear cuts ¾" x 8'-0" at 50 cuts per minute. Other size Steelwelds available for plate to one inch and lengths to 18 feet.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
1418 EAST 282ND ST. *WICKLIFFE, OHIO*

STEELWELD PIVOTED BLADE SHEARS



SUPERFINISH STARTS - OR STOPS - AT SCRATCH!

Perhaps you've thought of Superfinish only in terms of ultra-smooth surfaces. Not always! Here's one where the process has been stopped—controlled at a surface roughness of 10 micro inches. Note, in this magnification, how the abrasive grits have moved in paths which never duplicate, leaving a crosshatch pattern. For certain applications, such partially Superfinished surfaces have two distinct advantages: (1) removal of the soft "smear metal" left by grinding heat, (2) the crosshatch pattern maintains uniform distribution of lubricant to discourage spalling.

Superfinish has many other interesting applications. Write on your letterhead for the booklet, "Wear and Surface Finish."

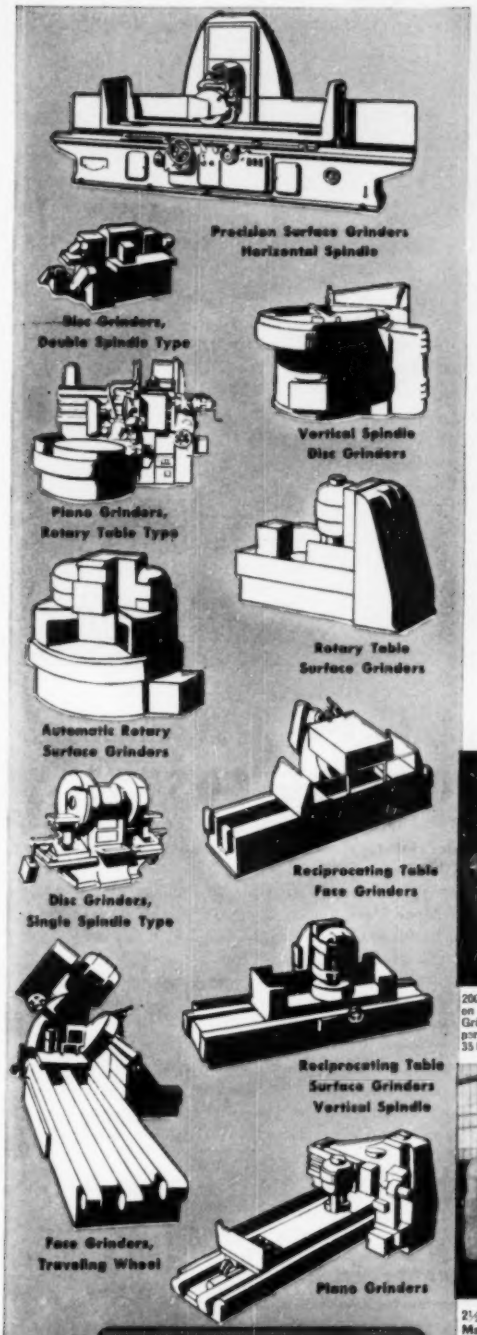
GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUNDTABLE
represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcome here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

MATTISON GRINDERS

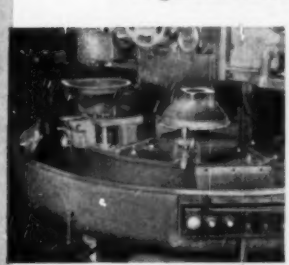
If its a Flat Surface to Grind
There's a Mattison to Grind it.



● With the addition of the production grinding machinery formerly made by the Hanchett Manufacturing Company, Mattison now is in a position to work with you on all your surface, face and disc grinding problems. These machines are made in various types to handle a wide range of work. Experienced fixture engineers are available to give you best production efficiency with Mattison Machines.

For any flat grinding, ask for our recommendations on the proper method and machine for your job. No obligation, of course.

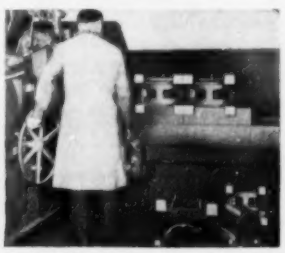
For catalog on all machines, ask for free copy of general bulletin.



200 Transmission Case surfaces ground per hour on Mattison (Hanchett Type) Rotary Automatic Grinder. A special 8-station mechanical fixture permits one operator to grind each end of this large 35 lb. casting, flat and parallel. Stock removal .050".

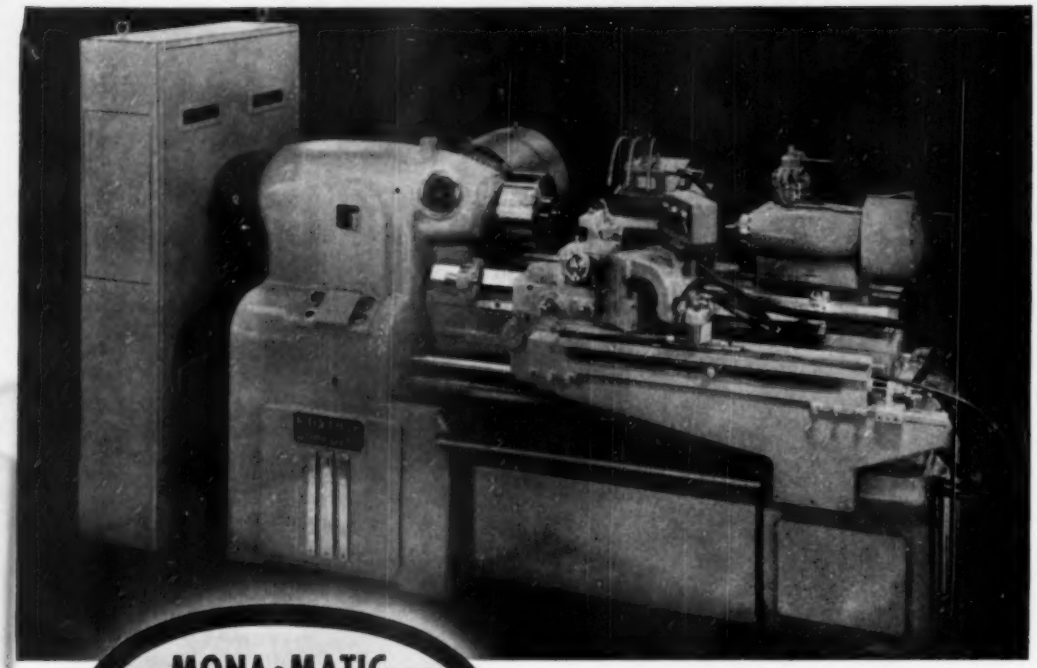
Grinding cast-iron cams — 5" diameter, 1½" thick — stock removal, each side .030". Production, 120 surfaces per hour on Mattison (Hanchett Type) Rotary Surface Grinder.

2½ ton machine-bed ground in 60% less time on Mattison Precision Surface Grinder than required by former method, hand scraping.



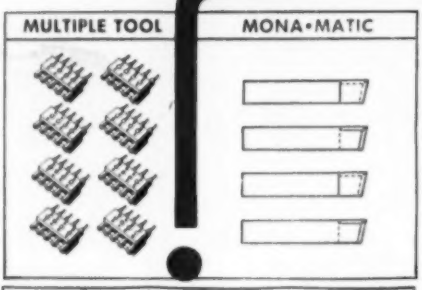
Grinding feet of motor frames from rough castings and welded assemblies on Mattison (Hanchett Type) Face Grinder.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS



MONA•MATIC or Multiple Tooling Methods ..WHICH?

LET'S TALK TOOLING COSTS!



	Multiple Tool Automatics (battery of four)	Mona-Matics (battery of two)
Production	120/hour	160/hour
Cutting Tools	**Cemented Carbide**	**Cemented Carbide**
No. of Tools	**40**	**4**
Cost of Tools (including one replacement set)	**$4220**	**$187**
Setup Time	28-30 hours	46 minutes
Total Horsepower	80-120	40
Floor Space	150-200% more than Mona-Matics	
Subsequent Grinding Operations		50% less time than multiple tool automatics

Would you rather pay $187—or $4,220 to tool up this job? It's just as simple as that.

On the typical steering knuckle job detailed at the left, *two* Mona-Matics, producing 33⅓% more parts than *four* multiple tool automatics, require *36 less tools* and *only two standard tool blocks!* And the multiple tool costs are figured on the basic minimum, two sets only. It might well be three or more sets, with correspondingly greater tool cost.

But bear in mind that lower tooling costs are not the whole story of the Mona-Matic's outstanding ability to cut your costs. You'll save on production time, on setup time, on accuracy, on power consumption and on floor space, too. For the full facts on how Monarch's famous Mona-Matics will outperform any ordinary multiple tool machining method, write for Bulletin 1804.

COMPARATIVE CASE STUDY

Part—Steering Knuckle,
SAE 1045, turned section—3 3/4" long, 3/4" to 3" diameter

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO. Sidney, Ohio

HERE'S HOW...

TO PLAN YOUR TOOLROOM HEAT TREATING DEPARTMENT

Published to assist those planning new or expanded heat treating departments. It's yours for the asking.

Material contained in this 24 page booklet, prepared by the Lindberg Engineering Company, is based upon years of experience in helping design hundreds of toolrooms . . . plus additional information gained from the 24-hour-a-day operating experiences of the toolroom heat treating department of the Lindberg Steel Treating Company, the world's largest.

It helps arrive at total costs in advance • Shows recommended department layouts • Tells how to select furnaces of proper size • Gives prices of auxiliary equipment such as tongs, quench tanks, straightening presses, hardness testers, work benches, etc. • Contains loose template pages of furnaces, quench tanks, etc. and graph paper . . . a few seconds of scissor work shows you how your department will look.

To get your copy write or call your nearest Lindberg Engineering Company office or the Lindberg home office at 2445 West Hubbard Street, Chicago 12, Illinois.

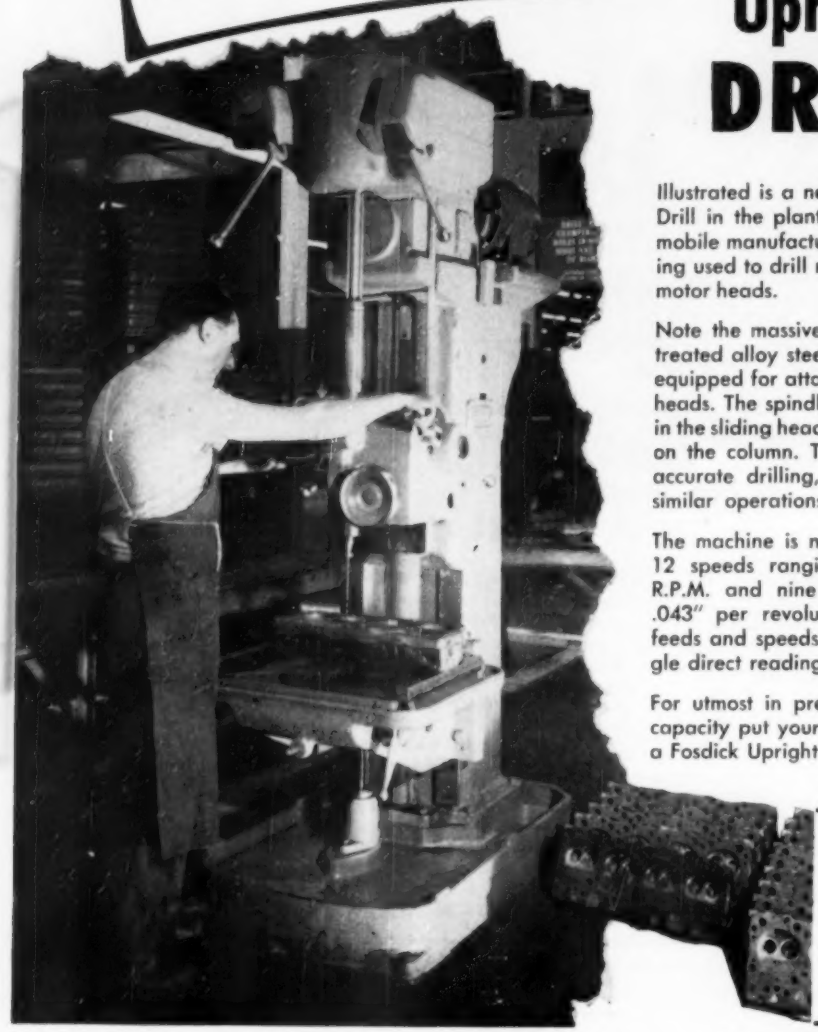
Other helps for Heat Treaters. "Heat Treating Hints"—a publication covering the practical side of heat treating with strictly "how to do it" articles. Available on request.

"Heat Treating Hints", two movies, (color and sound) bring to the screen practical articles from the printed "Heat Treating Hints". Ideal for technical associations, plant showings, schools. Write for Bookings.

LINDBERG FURNACES

RIGIDITY
that Assures Accuracy

FOSDICK
Upright
DRILL



Illustrated is a new Fosdick 25" Upright Drill in the plant of a prominent automobile manufacturer. The machine is being used to drill numerous small holes in motor heads.

Note the massive spindle made of heat treated alloy steel. The spindle sleeve is equipped for attachment of multiple drill heads. The spindle sleeve has a bearing in the sliding head equal to head bearing on the column. This assures rigidity for accurate drilling, reaming, boring and similar operations.

The machine is normally furnished with 12 speeds ranging from 60 to 1500 R.P.M. and nine feeds from .005" to .043" per revolution of spindle. Both feeds and speeds are controlled by single direct reading levers.

For utmost in precision and productive capacity put your drilling operations on a Fosdick Upright Drill.

Ask for
FOSDICK
Upright
Bulletin
U.D.A.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

HOW LONG
will the Life-Line bearing last?

As long as comparable periodically lubricated bearings—or longer!

BEARING MANUFACTURERS SAY: "Pre-lubricated bearings have the same life expectancy as periodically lubricated bearings *IF those periodically lubricated bearings are perfectly maintained.*" But how often is a bearing perfectly maintained? Not often enough! That's why Life-Line pre-lubricated bearings offer fewer motor outages due to lubrication faults.

OPERATING RECORDS SAY: "41% fewer failures with Life-Line pre-lubricated bearings!" Life-Line motors placed in service throughout industry show a record of 41% fewer bearing failures than the best conventional motor (with conventional bearings) ever built by Westinghouse!

USERS SAY: "Life-Line bearings save me money." One motor user reports yearly lubrication costs of $3.06 per motor on ordinary motor bearings. An industry average indicates a yearly cost of $2.70 per motor a year. Multiply this by the hundreds of motors in your plant and you'll see why pre-lubricated Life-Line offers you an opportunity to cut life costs of motors. Life-Line needs no lubrication. You save this cost.

Get all the facts on Life-Line motors. See for yourself how much you can save. Ask your Westinghouse salesman for copies of "Facts on Pre-Lubricated Bearings," (B-4378) and "Motor Costs" (B-4321), or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-21585

Westinghouse
Life-Line
Motors
INDUSTRY'S LEADING MOTOR

machined and *Assembled* in *One Chucking!* with GISHOLT TURRET LATHES

Talk about clever ideas! Here's one used by the Ansul Chemical Company, manufacturer of dry chemical fire extinguishers, to cut time, cut costs and do a better job.

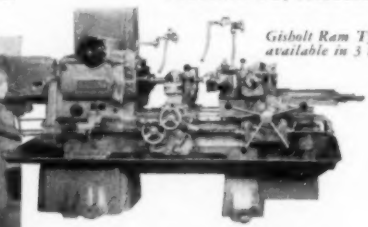
Eight different operations on these gas pressure cartridges are performed on a Gisholt No. 5 Ram Type Turret Lathe as follows: Turn, face, bore, thread, tap, attach splined collar, groove collar, and roll edge. And all in one chucking!

Combining all these operations on a Gisholt Turret Lathe eliminates another handling and welding operation—saves from 30% to 40% of former time. What's more, it has resulted in more uniform work and better appearance.

It's another example of using ingenuity to save money. Gisholt engineers are ready to give you the best of their experience—to help cut *your* time and costs. Write us.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

While part is still turning, splined collar is placed over neck of cartridge. Collar is then grooved and rolled to insure a snug fit that prevents turning or loosening.



Gisholt Ram Type Turret Lathes are available in 3 models with standard chuck sizes ranging from 8" to 15".

GISHOLT

The Gisholt Round Table *represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

ARE WOMEN SMARTER THAN MEN?
I DUNNO— WHY?
OUR COMPANY BUYS CUTTING TOOLS FROM 8 DIFFERENT MAKERS- MY WIFE SAID IF SHE BOUGHT GROCERIES AT 8 DIFFERENT PLACES, I WOULD HAVE TO HIRE SOMEONE TO KEEP HOUSE FOR HER!
WONDER WHAT HE MEANT?

Standardize and save

• You can save time in purchasing, in requisitioning, in stock keeping, in the tool crib when you specify Standard Shield Brand cutting tools. One responsible maker gives your requirements top attention. The Foremost Quality of Shield Brand Tools gives you top performance, attested by the fact that American mass production industries—automotive, aviation, farm implement, railroad, electrical and home appliance—regularly specify and use these fine tools. Their selection is based on merit alone.

Leading Mill Supply Distributors coast to coast supply these Foremost Quality tools. Our helpful suggestions on tough problems are yours for the asking.

STANDARD TOOL CO.

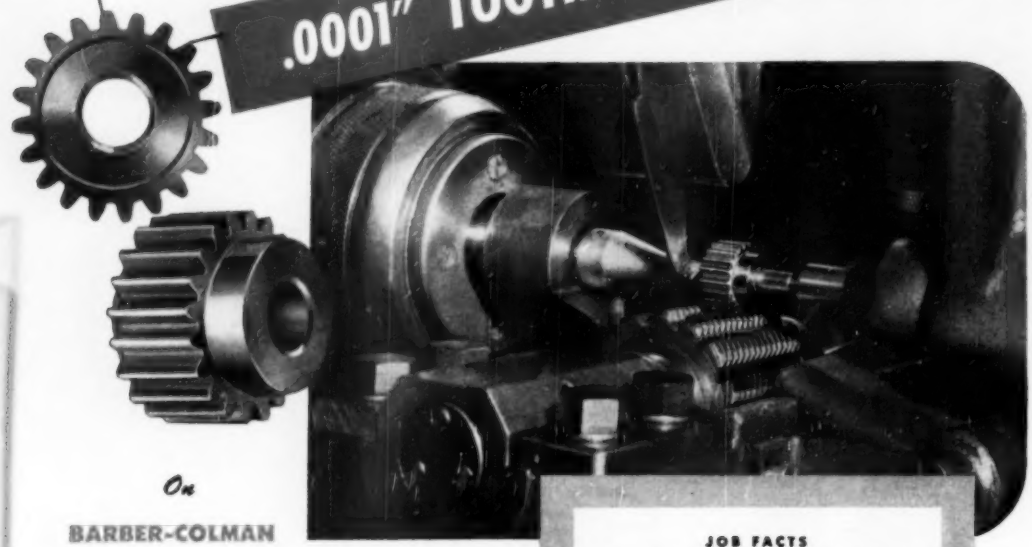
Successor to The Standard Tool Company

CLEVELAND 4, OHIO

New York • Detroit • Chicago

THE STANDARD LINE: Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools

PINIONS HELD TO .0001" TOOTH SPACING!



On

BARBER-COLMAN

No. 6-10

PRECISION

HOBBING MACHINE

JOB FACTS

Operation — Finish Hob Pinion 28 pitch, 20 teeth, .7143" P.D.
Material — Tough Bronze
Hobs — B-C Class A Precision 2⅛" x 1⅜" x taper bore
Fl-to-Fl — 5.35 minutes
Feed — .012" per rev.
Speed — 309 RPM
Tool Life — 180 Pieces per Hob Sharpening

This scale manufacturer reports about his Barber-Colman No. 6-10 Precision Hobbing Machine: "... we have searched the latest methods of producing precise and accurate pinions, and find regardless of cost limitations within reason, the method now in use is equal to any available or used to our knowledge elsewhere."

Precision cut gear teeth are of major importance in scale manufacture because any error in tooth form or spacing is reflected in the indicator on the scale. In this operation, conditions are ideal for accuracy, and pinions are hobbed to total indicator readings as follows: eccentricity, .0003"; individual tooth spacing error, .0001"; error from true involute form, .0001".

For maximum economy and accuracy in gear production, Standard and Precision No. 6-10 Hobbing Machines are now available for improved delivery. Write our engineering Department for additional information.

Barber-Colman Company

GENERAL OFFICES AND PLANT, 816 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

For details on the No. 6-10 Hobbing Machine, write for this free Bulletin No. 6130.

SCRAP SAVINGS of $16.75 per ton

"That's what I call piling up the dough!"

Comparison of borings and turnings, before crushing and after briquetting. Steel, cast iron or non-ferrous metal. Uniform in size and density.

IT PAYS to salvage scrap the modern MILWAUKEE way

The profits that can be made by converting bulky borings and turnings into higher value briquettes may in a short time exceed the cost of the entire briquetting plant. Let's take a concrete example. The cost figures shown here are taken from an actual case history from our files. They cover a 10 year average converted into 1948 costs. Note, in briquetting grey iron borings, the cost of the entire briquetting plant was amortized in 3 months. Frankly, can you think of any quicker way of making money?

Names of users of Milwaukee Briquetting Presses, are available on request.

✓check these figures:

Briquetting Grey Iron Borings

Labor, Power & Maintenance, per ton	$ 2.25
Material Cost*, per ton	36.00
Total Briquetting Cost, per ton	38.25
Cost of No. 1 Cast Iron Scrap*, per ton	55.00
Savings due to Briquetting Process, per ton	16.75
Savings per hour, based on producing 3½ tons of Briquettes, per hour	58.62

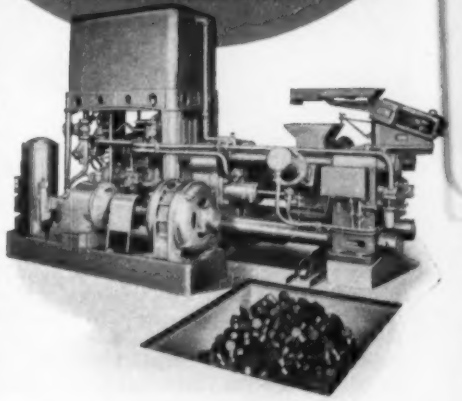
Briquetting Crushed Steel Turnings

Labor, Power & Maintenance, per ton	$ 3.00
Material cost*, per ton	34.50
Total Briquetting Cost, per ton	37.50
Cost of Heavy Melting Steel*, per ton	42.50
Savings due to Briquetting Process, per ton	5.00
Savings per hour, based on producing 2½ tons of Briquettes per hour	12.50

Cost of Briquetting Plant complete, including all equipment, hoppers, elevators, etc., ready to operate, approximately $55,000.00

Briquetting plant is completely amortized in 3 months to 18 months, depending on type and volume of borings or turnings used.

*Prices used in this report are based on 1948 average market price, f.o.b. Pittsburgh. Further savings in freight and handling will be realized if computation is made f.o.b. your plant.



Investigate the scrap savings possible in your plant. A Milwaukee Foundry Equipment Engineer will gladly help you. Write — today.

MILWAUKEE BRIQUETTING PRESS Compresses bulky scrap into compact briquettes (from 2¾" to 5" in diameter) at the rate of 720 briquettes per hour. Fully automatic. Controlled either hydraulically or electrically. 5 sizes available with capacities from ¾ ton to 4 tons per hour.

CORE BLOWERS • CORE GRINDERS • MOLDING MACHINES • BRIQUETTING PRESSES

MILWAUKEE Foundry Equipment

Division of SPO Inc.

3236 W. PIERCE STREET, MILWAUKEE 15, WISCONSIN, U.S.A.

DUPLICATE PARTS OR DO REGULAR LATHE WORK . . . Get instant changeover ONLY with the COPYMATIC!

When you're buying a lathe for *production* work, you're interested in *production* figures . . . actual shop records . . . NOT engineering tests, performed under ideal conditions. The figures above are on daily production, reported by COPYMATIC owners who compared their COPYMATICS with lathes formerly used.

Practical for large and small shops, the Lodge & Shipley COPYMATIC gives the *versatility* of the engine lathe and the *productive capacity* of automatic duplication . . . *without* the limited use and high cost of a special purpose machine.

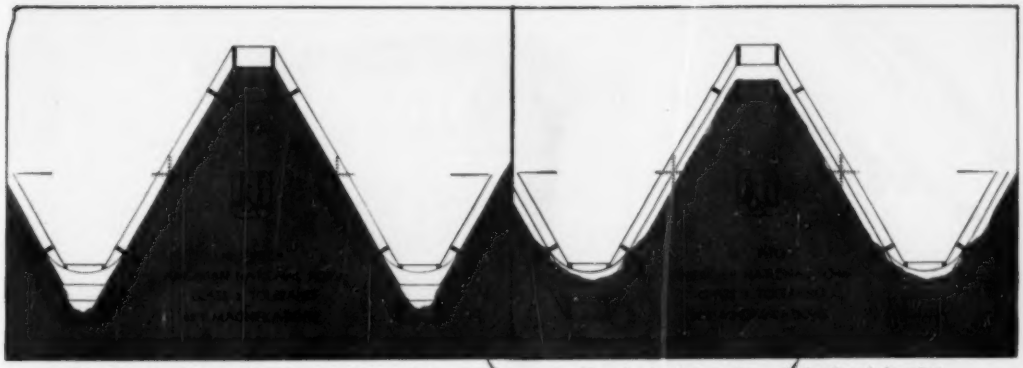
From round or flat templates, the COPYMATIC accurately duplicates square shoulder faces, grinding necks, tapers in both directions, chamfers and curved contours.

Often, the additional cost of making a special template is eliminated. The first piece of the lot is turned, using the machine as a standard lathe and then inserted between the template supports and used to produce the rest of the lot automatically.

The COPYMATIC can be a profitable producer in your shop. Ask your Lodge & Shipley Representative for details or write for Bulletin No. 675.

THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO



The enlarged shadow of the master thread is made to coincide with the correct tolerance outline on the chart.

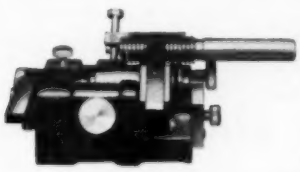
The enlarged shadow of a production thread, shows it to be of minimum pitch diameter—but irregularities would make it fit close in a mechanical gage.

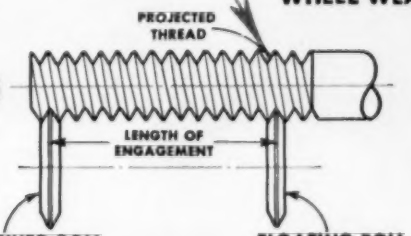
The NEW Jones & Lamson Universal Screw Stage

TELLS ALL... at a glance!

The new Universal Screw Stage for Jones & Lamson Optical Comparators provides *the only* method which simultaneously compares all the elements of a thread with a master gage. It checks *at a glance*, lead (for the whole length of screw engagement), pitch diameter and thread angle; crest, root and taper. The *enlarged shadow instantly reveals any* wear of the tool, chasers, rolling dies, or grinding wheel which produced the thread. It not only detects individual errors, but shows their *cumulative effect*. It is the only universal stage that will measure a wide range of diameters and pitches, as well as right or left-hand threads.

LEAD
PITCH DIAMETER
THREAD ANGLE
CREST
ROOT
TAPER
TOOL WEAR
WHEEL WEAR





Write to Dept. 710
for descriptive folder giving complete details. This Stage can be used on any Jones & Lamson Comparator.

FIXED ROLL
set for length of engagement relative to floating roll

FLOATING ROLL
adjusts itself to lead error

Optical Comparator Division

JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

Cut...

LARGE HOLES

. . . thru any machineable material up to $1\frac{1}{8}$ *INCHES* thick!

Here is a premium tool which makes it possible to saw holes in one short operation . . . large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

MARVEL High Speed-Edge Hole Saws come in 35 sizes, from $\frac{5}{8}$" to $4\frac{1}{2}$". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-49

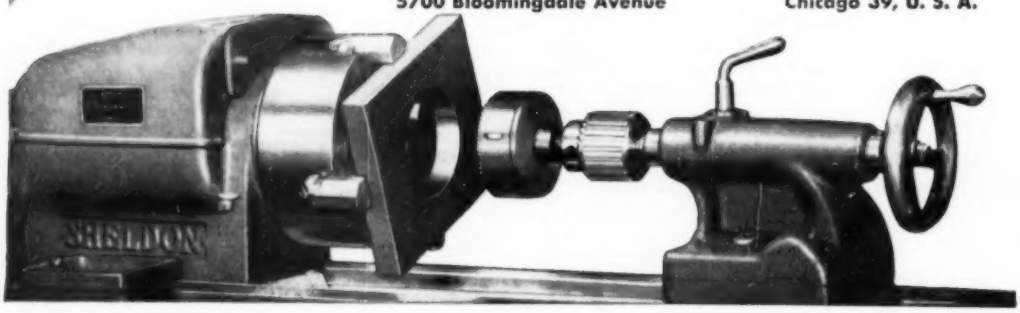
"MARVEL" *has Always had the edge!*

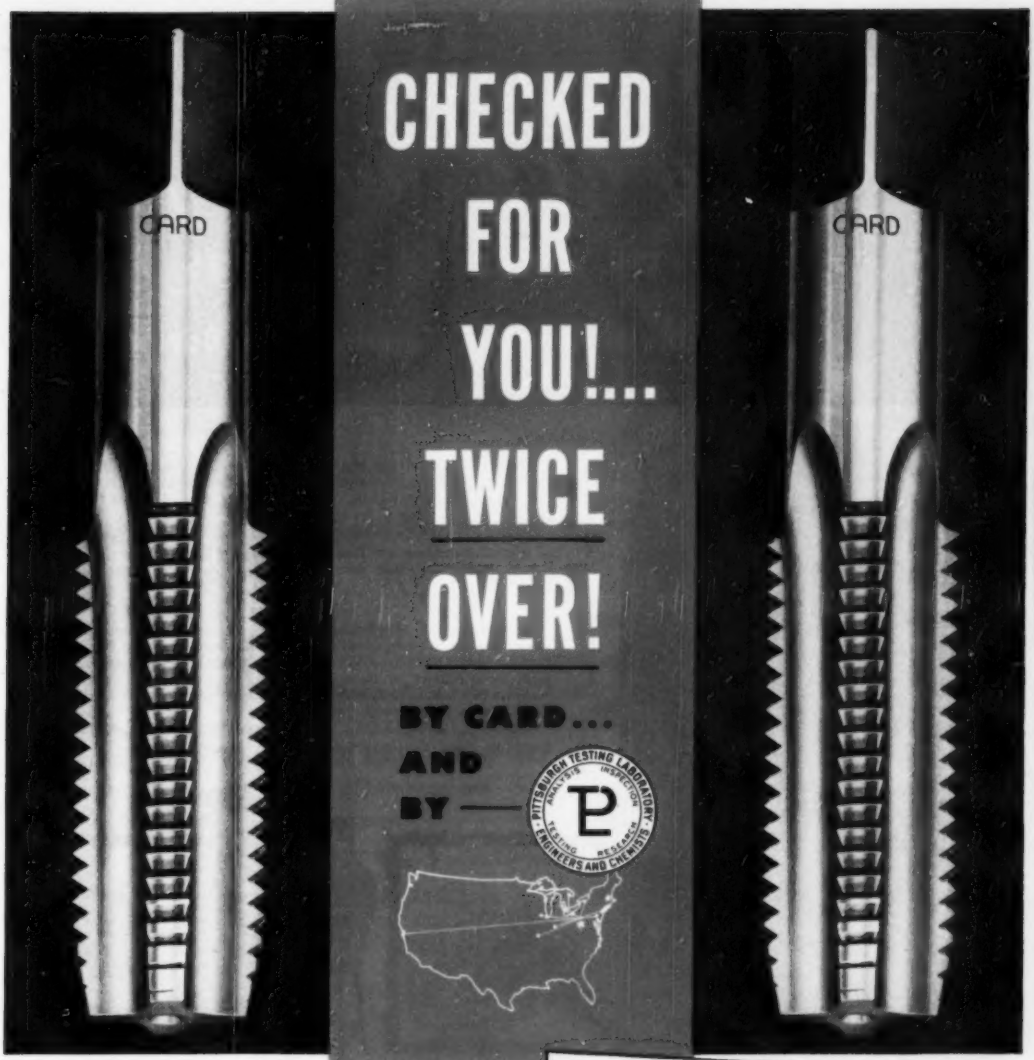
MARVEL *Metal Cutting* **SAWS**

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Avenue **Chicago 39, U. S. A.**





Card's system of *double* inspection — in the factory and independently, by the Pittsburgh Testing Laboratory — is your *double* assurance of satisfaction when you specify Card Taps... See your nearest Card Distributor for prompt, dependable service.

S. W. CARD

MANUFACTURING COMPANY
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL CO.

The CARD Quality

TAPS

The Certified Cutting Tools*

*by the Pittsburgh Testing Laboratory

Also makers of DIES · SCREW PLATES
DIE STOCKS · TAP WRENCHES

NATCO OFFERS YOU

the long and short of it

FOR GREATER SAVINGS...

Multi-Drilling, Tapping and Boring

The illustrations here show the wide range of work possible on NATCO drilling machines. Whether your problem involves very large, medium size or very small parts, there is a NATCO machine to suit your purpose.

The NATCO HOLESTEEL Machine at left is a giant capable of precision drilling 105 holes in the huge cylinder block shown below. Hole sizes range from .3125 to 1.0156.

In meeting the requirements of the smallest light sensitive work, the A-33 Multi-spindle Driller and Tapper shown below is outstanding. The plastic camera case is multi-drilled on four sides by a battery of these A-33 machines turning out highly accurate work at the rate of 250 parts per hour. The 29 holes drilled range in size from .0465 to .281.

Regardless of the size of your job, it will pay you to call a NATCO Field Engineer for profitable suggestions.

NATCO C6A HOLESTEEL MACHINE and a massive tractor engine casting machined on it for a large manufacturer.

NATCO A33 LIGHT SENSITIVE MULTI-DRILLER AND TAPPER and small camera part drilled on a battery of A33's.

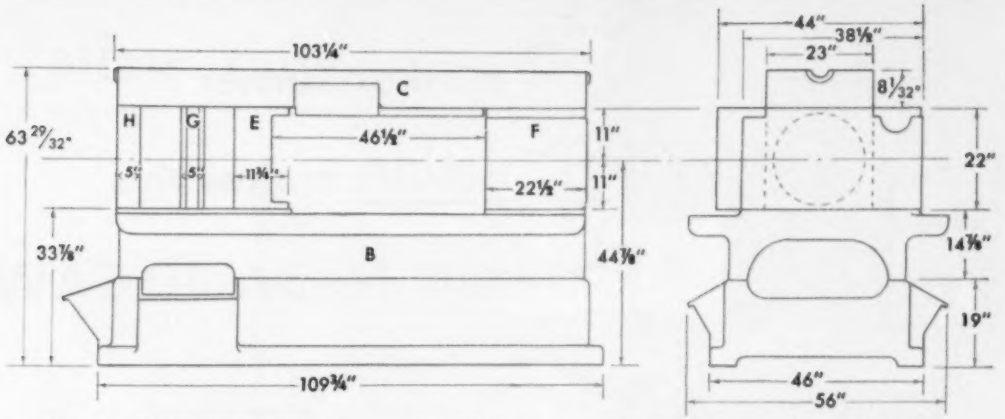
WRITE TODAY for "Success Stories From the Brief Case of a NATCO Field Engineer" . . . NATCO, Richmond, Ind.

Call a Natco Field Engineer

Offices

1809 Engineering Bldg., Chicago
409 New Center Bldg., Detroit
1807 Elmwood Ave., Buffalo
2902 Commerce Bldg., New York City

National Automatic Tool Co., Inc.
RICHMOND, INDIANA, DEPT. A.M.



H, G, E — HEADSTOCK SUPPORTS Weight — 1233 lbs. | **B — BASE** Weight — 6655 lbs. | **C — TOP BED** Weight — 1232 lbs. | **F — GEAR BOX** Weight — 841 lbs.

BE VALUE WISE OR OTHERWISE

True of any "means goods," the purchase price of any Multiple Spindle Bar Automatic is only relative. It is "high" or "low" on the basis of the total cost of its total services, compared to other brands. Important items of total cost are those of operation and maintenance.

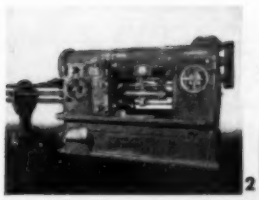
Machine analysis will invariably disclose the low cost operation and maintenance features that have been "built into" a machine. Such features are built into the CONOMATIC, beginning with its very foundation. The figures above substantiate the claims below.

THE 1½" Six Spindle MACHINE FRAME:

1. **Provides greater capacity for handling work.** — *The Frame provides a LONGER TOOLING AREA, with more positions and accommodations for tooling and attachment applications, with more clearance and conveniences for faster tool setting, than are provided by any other "automatic."*

2. **Provides better support to work and tools.** — *The Frame provides better support and alignment to headstock members, tool slides, and other units and mechanisms, with BASE SUPPORT CLOSER TO THE WORK AXIS, with BETTER TOP BED SUPPORT TO SHORTER, "WEAVE PROOF," UPRIGHTS, and, with larger, heavier, and stronger, Top Bed and Base, than are provided by any other "automatic."*

3. **Provides greater accessibility for lower cost operation and maintenance.** — *The Frame provides a more orderly arrangement of, and easier access to, all units, mechanisms, parts, and adjustments, than can possibly be provided by any "automatic" that does not have a VISIBLY ACCESSIBLE, NON-INTERFERING CAM SYSTEM.*



Buyer's Comparison Chart will guide you to full information

A Comparison of ALL Automatics is in Favor of Cone

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

Walker-Turner *design* makes this *new* 16" BAND SAW a *cost-cutting* machine!

. . . designed to cut metal-cutting costs.

NEW POWER FEED protects blade against distortion. Motor driven, it maintains a pre-set feeding pressure. Easily adjusted for blade condition and various types of material.

walker-turner DIVISION

● You would expect this Walker-Turner machine to be efficient. But you'd have to *operate it*, in your own plant, to appreciate how quickly, accurately and economically this new 16" Band Saw cuts sheets, rods and tubes of steel, iron, aluminum, brass, alloys and compositions, or molded plastics.

Secret of its high operating efficiency is Walker-Turner *unit design*. Main column of the machine, for example, supports the two cast iron wheel housings, which in turn carry the wheel bearings and other elements of the saw.

Wheel housings are fitted with strong, lightweight covers that completely shield saw blades and wheels. Design improvements in upper and lower blade guides give maximum support to both wide and narrow saw blades. Easily adjusted roller provides back support on the upper guide. Every basic part is completely functional!

Find out more about Walker-Turner designing . . . how it can help you to increase production and lower machining costs. See your local authorized Walker-Turner dealer or mail coupon for catalog describing the complete Walker-Turner money-saving line.

Walker-Turner Division, Kearney & Trecker Corp.
Dept. AM2, Plainfield, N. J., U. S. A.

Please send me a copy of the new Walker-Turner Catalog.

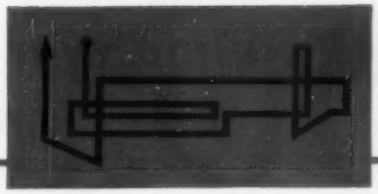
Name .....

Firm .....

City ..... Zone ..... State .....

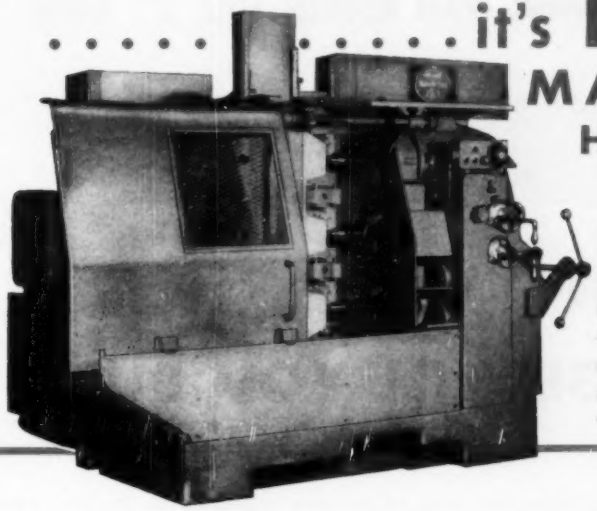
KEARNEY & TRECKER
MILWAUKEE

WALKER-TURNER DIVISION
PLAINFIELD, NEW JERSEY

Follow this  Tool Path

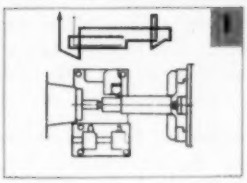
. . . . . it's **BULLARD**

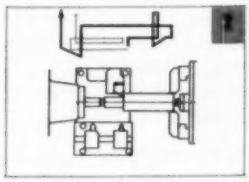
MAN-AU-TROL HORIZONTAL LATHE MODEL 30H

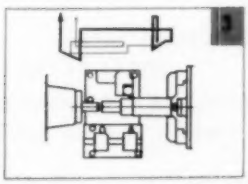


For Between Center Work On Shafts And Chucking Jobs Requiring — *Turning* — *Grooving* — *Facing* — *and Angular Turning.*

Fully automatic for Production runs or operated manually for short runs without disturbing the automatic setup.



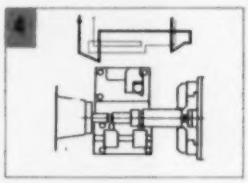


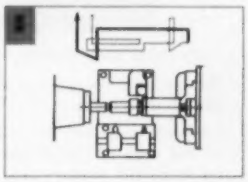


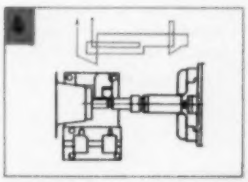
Man-Au-Trol has no predetermined sequence of operating functions, except when set for a given job. No cams are used for the movement of saddle or tool slide or for dwell at the end of a cut. Repetitive accuracy and uniformity of finished work is assured. 1 Drive pinion Shaft SAE 3250 Bar Stock steel (size 3" x 11¾") 1st. Oper. rough turn. 2 2nd Oper. Finish turn to size. 3 3rd Oper. finish turn to size. 4 4th Oper. Lower tools groove and chamfer end. 5 5th Oper. Upper tool enters groove generates 30 degree angle and finish turns to shoulder. 6 6th Oper. finish face end of shaft. Production per hour 52 pieces.

16MM SOUND MOTION PICTURE

Showing the setup and operation of the Bullard 30H Lathe is available for group showing. — When writing advise your preferred date.







THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

Van Keuren WIRE TYPE PLUG GAGES

VAN KEUREN FULL 2" GAGE

AGD 1¼" GAGE

WHICH GAGE WILL YOU BUY?

CATALOG AND HANDBOOK No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies are now free upon request.

Wire Type Plug Gages were originated by The Van Keuren Co. over 25 years ago. In 1948 this design was adopted in shorter lengths as the AGD standard for gaging holes from .030" to .510" diameter. The Van Keuren Co., because of years of pioneering, is able to offer the extra length at little or no extra cost.

You cannot afford to lose this extra length. When you need plug gages obtain a quotation from The Van Keuren Co.—Compare COST PER HOLE GAGED. You can be assured of quality and accuracy. A double inspection at the factory eliminates your inspection expense. No time will be lost waiting for replacements. You can count on prompt delivery from a stock of 2 million wires. Specify Van Keuren wire type gages and get the most GAGE for your GAGE DOLLAR.

Send for Supplement 19 showing quick and easy method of getting 4 to 10 gages from 1 VK wire type gage unit.

Available in

TOOL STEEL **HIGH SPEED**
CHROMIUM PLATE **VK CARBOLOY**

FOR SUPERSERVICE **Phone Watertown 4-4394**

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

Tough Sledding...

A leading ladder-maker's sales weren't climbing like they should. "I have to cut production costs and make a better ladder to boot." He wanted to use magnesium, but heard it rumored that handling it was tough sledding. To find out for himself, he called light metal headquarters, Aluminum Company of America. He learned that fellow-manufacturers were using a million pounds of magnesium every month That minor changes in shop procedure make handling magnesium easy.* He found that using extruded magnesium parts eliminate most machining. With personal help from Alcoa Engineers, plus books on designing and fabricating he took advantage of magnesium's high strength-weight ratio. His side rails and rungs are extruded by American Magnesium Corporation. His lighter, stronger ladder is stepping ahead of competition.

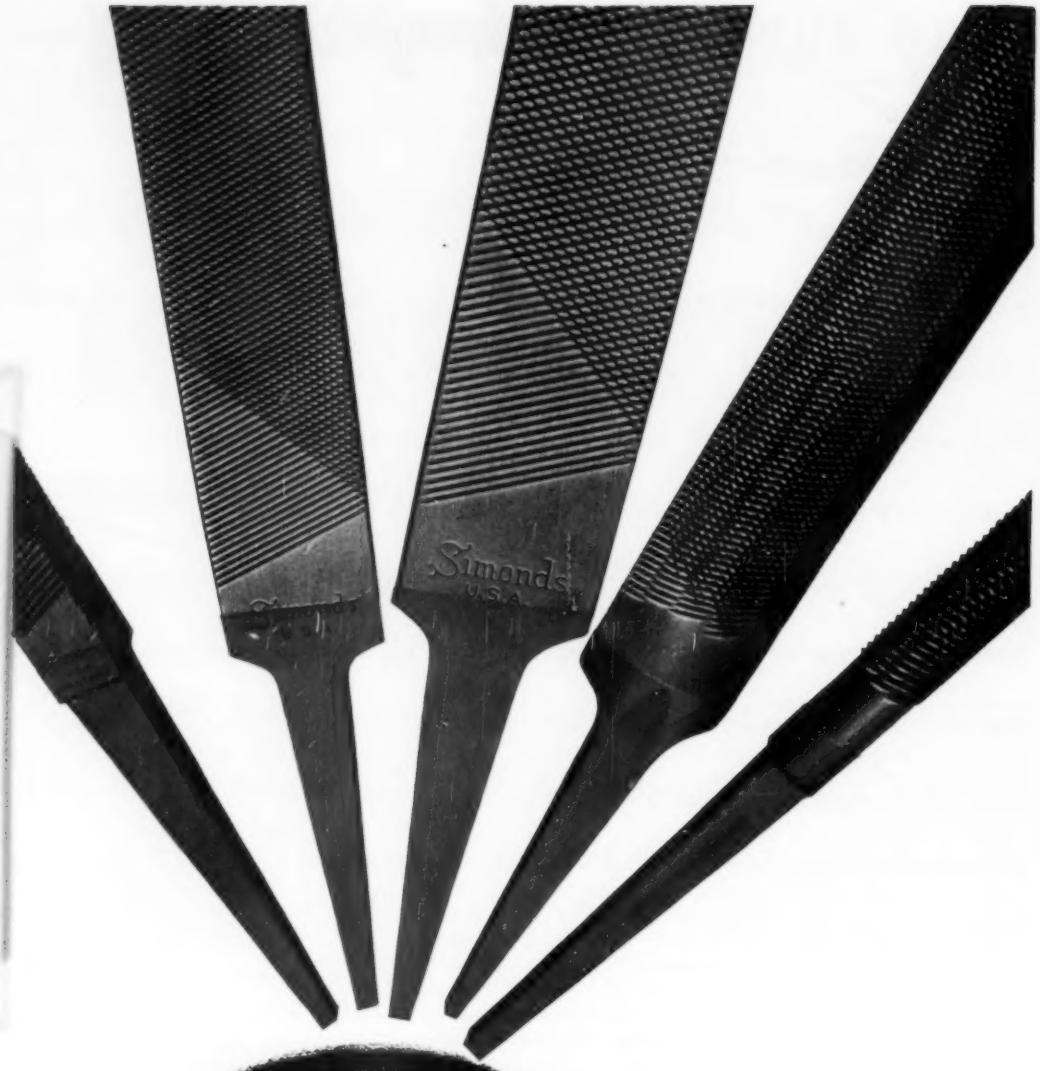
*No change in insurance rates.

These two free books on magnesium and our broad technical experience can help your products, too. Write Aluminum Company of America, sales agent for American Magnesium Products, 2106B Gulf Bldg., Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

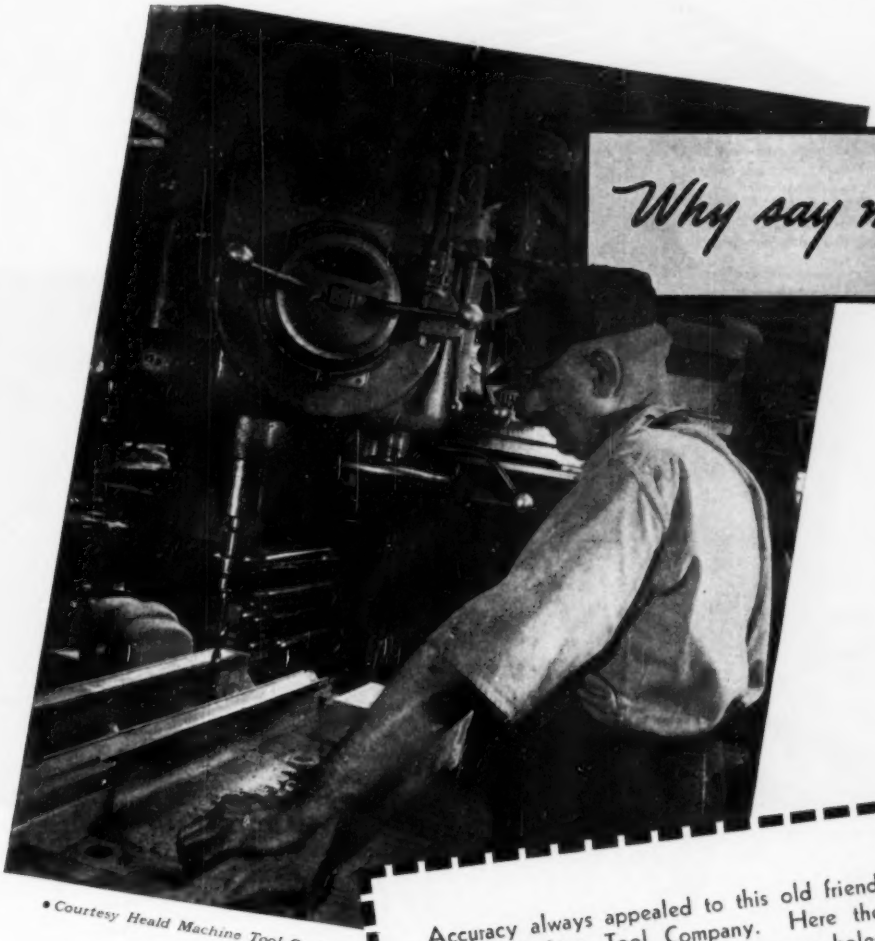


These RED TANGS Mean More File-Mileage

There's no other file like a "Red Tang" File, because: 1—It's the only file made to Simonds' single standard of quality. 2—It's the only file made with teeth designed like Simonds Metal-Cutting Saw teeth . . . teeth that *cut* instead of scrape. 3—Every "Red Tang" File is *individually* hardened, brine-quenched, and straightened. Prove Simonds Consistent Cut-Ability for yourself. See your Industrial Supply Distributor . . . or call the nearest Simonds office . . . and get *more file-miles per dollar.*

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.
Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

SIMONDS — Special Electric Furnace Steels
SIMONDS — Grinding Wheels and Grains
SIMONDS — Simonds Products for Canada



Why say more?

• Courtesy Heald Machine Tool Company

Accuracy always appealed to this old friend—The Heald Machine Tool Company. Here they are boring, facing and reaming numerous holes in a 1360-lb. casting.

They say, and we quote: "We bought this Cincinnati Bickford Super-Service Radial Drill to increase war-time production. We also have ten large and a flock of smaller ones. Why say more?"

Cincinnati Bickford Super-Service Radial Drills are always accurate, dependable tools, highly productive and profitable in the shop.

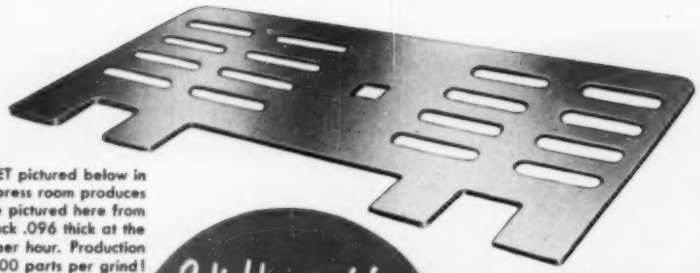
Write for Bulletin R-24A.

See our condensed Catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



The DANLY DIE SET pictured below in the shop and in the press room produces the pressure plate pictured here from 1010 C.R.S. strip stock .096 thick at the rate of 600 pieces per hour. Production averages 100,000 parts per grind!

Reliable precision in the die shop with DANLY DIE SETS

And more parts per grind on the production line!

HERE'S WHY...

Hardened, ground and lapped pins make die assembly work quicker, easier and more accurate. Close guide post and bushing fits assure precise die relationship and longer die life. Danly Die Sets assure the lasting performance of your dies.

And they mean greater convenience, too! Whatever your needs, a Danly Die Set is quickly available. All standard sets are stocked in a nationwide system of Danly assembly branches!

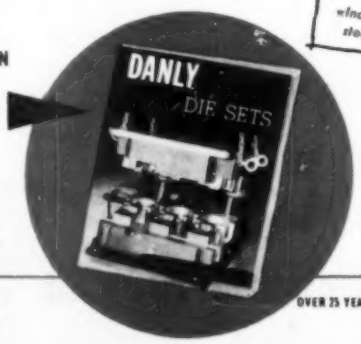
Which DANLY branch is closest to you?

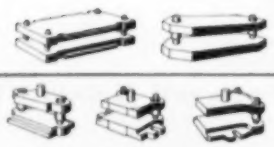
- *Chicago 50, 2100 South 52nd Avenue
- *Cleveland 14, 1550 East 33rd Street
- *Dayton 2, 990 East Monument Avenue
- *Detroit 16, 1549 Temple Avenue
- *Grand Rapids, 113 Michigan Street, N.W.
- *Long Island City 1, 47-28 37th Street
- *Los Angeles 54, Ducommun Metals & Supply Co., 4890 South Alameda
- Milwaukee 2, 111 East Wisconsin Avenue
- Philadelphia 44, 18 West Chelten Avenue
- *Rochester 4, 16 Commercial Street

*Indicates complete stock

WRITE FOR THIS FREE BULLETIN

. . . and see how Danly's special die set machining service will mean important savings in your tool shop.





DANLY

DANLY MACHINE SPECIALTIES, Inc.

2100 South 52nd Avenue, Chicago 50, Illinois

OVER 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

SPOT NEWS OF METALWORKING

New procedure for handling drawings uses an autopositive cloth made by Eastman Kodak. Both Ford Motor and Ingersoll-Rand have done development work on the cloth, which is being announced for general distribution this month. Objective: to reduce drafting costs.

Ford will make more units in first half of 1950 than in Model T days. It intends to build 600,000 Ford passenger cars, 150,000 trucks and 150,000 Mercury and Lincoln cars. With tractors added, output in January-June period will be 989,918 units. Previous high, in 1924, was 982,415 units.

German machine tools are being offered in France at 10% less than French-built machines. French production costs are up. It takes 60% more workmen today to turn out same number of machine tools as prewar. When more than 50 men work in a shop, committee of direction is organized — by law. Production is limited to 2,000 hr annually.

Inexpensive radio set good enough to bring in local broadcasting stations is being planned by auto radio manufacturer. It anticipates market in which cars may be sold without any or at least very little extra equipment.

Nash's proposed 100-inch wheelbase car, with small six engine, will do about 80 mph or better, gets 27 to 30 miles to gallon of gas, weighs around 2500 lb, is tight five-passenger and comfortable four-passenger car, uses super-balloon tires on 15-in. wheels, say reliable reports.

A new measuring machine has been devised which will select in sequence quantities to be measured, make measurement, transmit reading as far as desired, and record them in numerical form properly tabulated. Machine combines electronic computer technique with that of printing telegraph and records data by means of "log sheets," which may be easily read and transmitted. This eliminates use of curves and other recording data, saves time and labor.

A special reduction-of-area gage has been devised for determining the mechanical properties of metals and alloys completely submerged in a temperature-controlled bath of from —196° C to +100° C. The gage provides measurements accurate to 0.0001 in. Gage consists essentially of one sliding and two fixed anvils connected through a lever mechanism to a dial gage.

Orders for machine tools for new Chrysler eight-cylinder engine have been placed, with deliveries sought by May 1. New engine is supposed to be ready for production by next August at De Soto plant in Detroit. Part of De Soto's operations have been moved to old Graham-Paige factory to make room. New six-cylinder engine for Dodge will be next on Chrysler Corp.'s tooling program after Chrysler eight engine.

First Swedish-designed jet engine, shown in Stockholm, has static thrust of only 3200 lb, has axial-flow compressor, six combustion chambers and fixed tail pipe. Known as the Skuten, new engine was made by Svenska Turbinfabriks AB Ljungstrom, Finspong, leading Swedish maker of turbines. De Havilland jets are being produced in Sweden under license.

Dana Corp., Toledo, Ohio, may convert into dollars its receipts on $65,000 investment in French Societe Glaenzer Spicer of Poissy, France, under ECA industrial guaranty contract. Dana's investment, a loan, is repayable in 10 yearly installments without interest. Glaenzer Spicer is leading maker of propeller shafts and universal joints.

English Electric turbojet bomber Canberra, powered with two Rolls Royce engines, will be built in Melbourne, Australia, by Commonwealth Aircraft Corp., in which DeHavilland recently bought out General Motors' interests. CAC also will make Rolls Royce Tay turbojets.

Gaging Metalworking

The unexpected strike at Chrysler, with its bad effect on suppliers, proved a blow to metalworking operations during the late days of January. Despite this interruption, the nation's metalworking industries as a whole have maintained their work schedules at a high level. And February promises to be good, too.

At the same time that the Chrysler shutdown put the news spotlight on Detroit in an unfavorable way, the automobile industry (including Chrysler) was generating new business for machine tool and press builders by proceeding with new tooling programs.

Automotive Plans Ambitious

The automobile industry still is looked upon as one of the mainstays of Metalworking during the first half of this year. Its plans are terrific. Ford alone is counting on making 5000 units a day during April, May and June. General Motors officials are predicting that the industry will operate at better than a six-million-car rate from January 1 to June 30. The "independents" have ambitious ideas.

► Real key to automotive demand is used-car prices. They have been trending downward for a long time, and still are headed for lower levels. About March or April they will reach the point in the Chevrolet-Ford-Plymouth class at which stiff competition will begin.

Retail dealers lose money on trade-ins during normal times. That means that they bid too high on new-car deals involving allowances on old cars. They trade away part of their profits. They are not doing that yet. They are down near the break-even spot on used-car allowances. It won't be long, though, before they will be back near their old position of enticing customers with high prices for their old vehicles. And the fun will begin. In other words, a knife-sharp competitive market is close at hand. That is why 1951 models will bring more changes than have been seen in the automobile industry at any time since the 1930's.

Consumer Goods Output Thrives

The big push is not all in automobile manufacture. It fans out into many metalworking lines, including both consumer and durable goods. The short-term plans in refrigerators, ranges and a multitude of household appliances specify full or near-capacity output. Take Hotpoint as an example. Its operations ahead call for assemblies of its products on a 100% capacity scale. And it intends to add as soon as possible to its productive facilities.

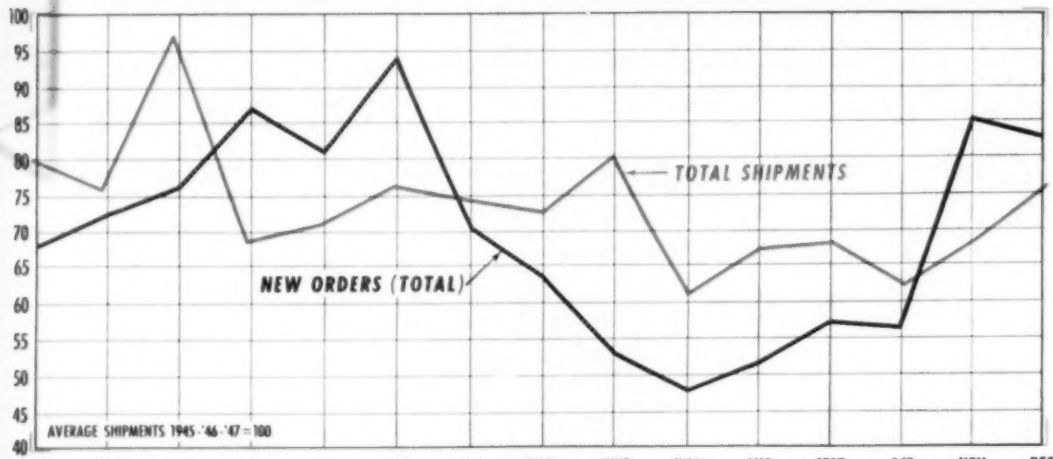
Easy Washing Machine is another example. Its production this quarter will be about the same as in the final quarter of 1949. That means that it is up 25% from the first quarter of last year.

► Some 3½ million television sets will be built this year. The entire electronics industry, in fact, will establish a new sales record. The government market for electronics equipment is estimated at $300 million for 1950. Apart from television, about 9 million radio receiving sets will be manufactured this year.

Turbine Production at Peak

Good news comes from General Electric about turbine production. In 1949 a new record was set, with output of 2.7 million kilowatts of fuel-fired electric generating capacity for electric utilities. This rec-

SLIGHT DROP IN NEW MACHINE TOOL ORDERS; SHIPMENTS RISE

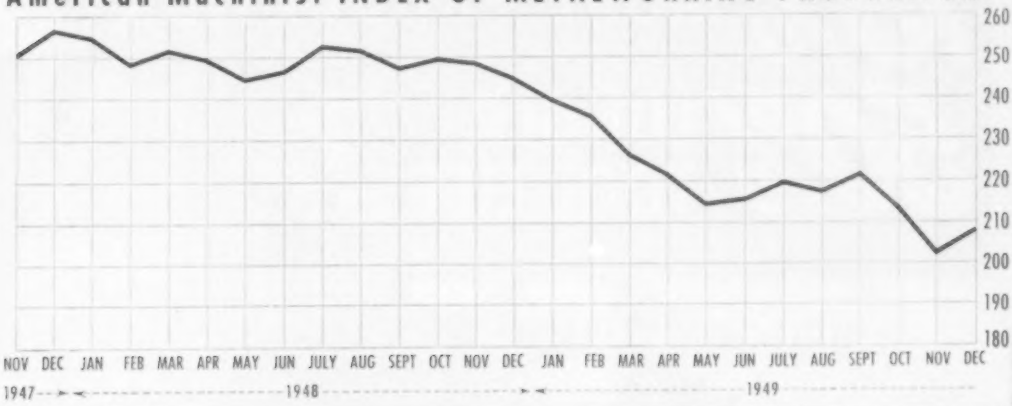


	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
New Orders (Total)				87.0	80.9	93.5	70.1	63.7	53.6	48.0	51.5	57.7	56.8	84.3	p82.5
Foreign Orders (Incl. in Total)				21.9	26.5	22.3	23.1	15.9	15.7	14.0	18.8	13.7	13.7	17.1	p22.4
Shipments (Total)				68.8	70.3	75.8	74.9	72.8	79.0	60.7	67.3	67.6	62.3	68.0	p75.7

Data: NMTBA

p—preliminary figures

American Machinist INDEX OF METALWORKING PRODUCTION



INDEX		COMPONENTS				
		MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANS-PORTATION EQUIP.	OTHER METAL-WORKING
Dec. 1949 (preliminary	208	186	232	195	229	227
Nov. 1949 (revised)	203	187	233	165	226	223
Dec. 1948	245	247	266	203	258	262

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

ord will be exceeded, however, this year, when production should get up to 3-million kilowatts. Relatively, the same favorable situation exists with other turbine builders.

► Production of tractors and road machinery promises to be good. Public construction work is at a high mark and will stay there all year. Farm implement manufacturers say that demand will be steady, though admittedly farmers will have less to spend this year than last.

Diesel-electric locomotive makers are pushing their plant facilities to get out as many units as possible—passenger, freight and switcher units. Heavy schedules will continue for several months or longer.

Tool Orders Above Shipments

The machine tool industry closed 1949 with shipments for the year just a trifle under $250 million. New orders for the same period, surprisingly, were above shipments in dollars.

December machine tool orders were 82.5 on the index of the National Machine Tool Builders' Association (with average shipments in 1945-1946-1947 taken as 100). That was down unimportantly from 84.3 in November. Shipments during December amounted to 75.7 on the index, a considerable rise from 67.6 the previous month, but still below expectations.

Export bookings in December jumped to 27% of new orders, thanks to ECA-inspired business.

January Sales Up

January sales of machine tools are believed to have been above the December figure, 1950 having got off to a good start. Much of the support came from Detroit, where automobile companies are deep into plans for 1951 models. Most-talked-about tooling program is for the new eight-cylinder engine for Chrysler Division of Chrysler Corp. Orders have been placed. Chrysler wants deliveries in May and should like to begin making engines by August. But suppliers, and probably Chrysler too, have their fingers crossed. On the heels of the Chrysler eight will be a big tooling program for a Dodge six.

These Chrysler developments are on top of substantial new-engine business in the offing at Ford and already "in the works" at Studebaker. And, over and above these tooling developments, are the new automatic transmission programs. Altogether, Detroit is much in the machine tool news and will remain there for many months ahead.

Auto Tooling Heavy

Automotive buying will fill up many machine tool companies the next few months. But the orders will not be well distributed throughout the industry. Builders of special-purpose equipment will gain mostly. But the resurgence in machine tool orders is not confined to automotive circles. There has been an upturn in business from other industries, too.

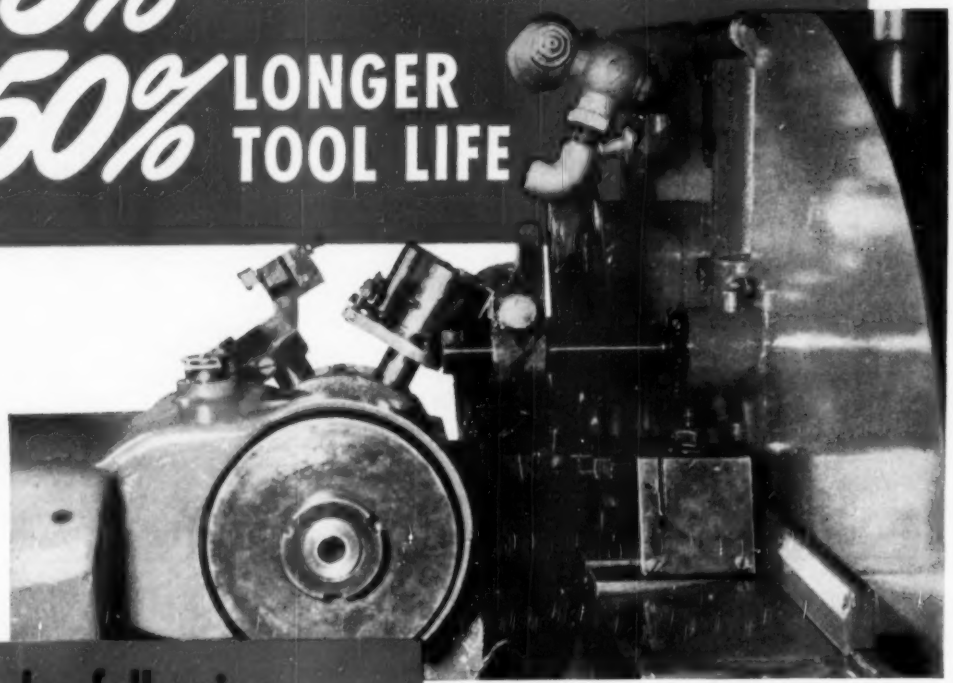
Export sources should yield important orders in the near future. These orders are tougher to get, because of devaluation, but they are coming from England, France, Italy and Germany in particular.

American Machinist Index Rises

Metalworking production in December stood at 208 on the AMERICAN MACHINIST index, with 1939 as 100 (based on manhours worked). That was a rise of five points from 203 in November. The gain is mainly accounted for by a recovery in automobile production, as the motor car industry got over the effects of the steel strike.

There is little change in the steel situation, which continues to trouble users because of shortages, particularly in sheet and strip. Mills are not worried about demand the first half; but they have doubts about how long beyond that period heavy sales will be sustained. Main pressure from consumers stems from fear that the coal impasse may result in curtailment of steel output.

15% MORE PRODUCTION
50% LONGER TOOL LIFE



...by following the Texaco Lubrication Engineer's recommendation

A California manufacturer* machining SAE 1018 steel on Brown & Sharpe automatics, was experiencing excessive tool failures and having difficulty in getting proper finish on parts. After a thorough study of the machining operations and the condition of the cutting tools, a Texaco Lubrication Engineer recommended *Texaco Transultex Cutting Oil* to overcome the trouble.

Results of following this recommendation have been: (1) desired finish obtained, (2) increase of about 50% in tool life, (3) 15% increase in production output due to a 15-second reduction in the machine time cycle.

Whatever machining you are doing, there is a Texaco Cutting, Grinding or Soluble Oil to do it more effectively. And a Texaco Lubrication Engineer, specializing in machining operations, will gladly help you select the right coolants to help you work your metal better, faster and at lower cost.

Get these benefits in *your* plant. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

*Name on request

TEXACO

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

TUNE IN . . . TEXACO presents MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

When To Buy A New Machine

Equipment users long have dreamed of a simple machinery replacement formula. Now they have one.

It consists of a one-page work sheet which enables the user to do something that he has never been able to do before.

He can combine shop arithmetic with so-called "upstairs arithmetic" and arrive at a logical conclusion—whether or not the new machine should be bought.

Heretofore there were likely to be two different answers. The production man, using shop mathematics, computed the annual savings to be made production-wise. This figure was not the same as the one with which the financial men in the front office came up. For the latter dealt with depreciation and federal income taxes, among other factors, in figuring the profit to be gained from installing a new machine.

The new formula does, essentially in one operation, the job of checking each machine from two points of view—shop management and production management. It is explained in detail in a booklet just distributed by the National Machine Tool Builders' Association entitled "Computing Return On Invested Capital." The work sheet is printed on the final page.

For the first time, worked out in black and white, the user now can see in dollars-and-cents detail the effect of new machine tools on his operations. Up to now he has not been able to measure accurately and quickly his potential profit from replacement of old machines by new ones.

There is no longer the need to rely upon the vague conclusion that a new machine "probably will save money." He knows whether it does—and how much.

First step in this new machine-tool arithmetic is to find out what the new machine will save in direct-labor costs. The next step is to evaluate all the factors, such as "fringe benefits," which must be considered in arriving at a true labor cost. The third, and final, step has to do with depreciation and federal income taxes.

That's all there is to it. The machine-tool user who progresses through these three simple steps, using the suggested work sheet, will come up with the annual net return on investment in new equipment.

Here is a simple, direct method of checking your machines. It is adaptable to every metalworking plant, large or small. Why not try it?

Burnham Finney

EDITOR

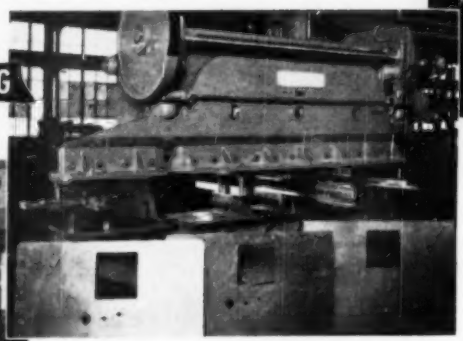
CINCINNATI
50 Series Press Brake

BENDING

MULTIPLE OPERATIONS

USE THIS CINCINNATI FOR ECONOMY...

BLANKING



PUNCHING and PIERCING

For economical handling of the many jobs where greater pressures and larger machines are not required, the Cincinnati 50 Series Press Brakes are outstanding in their performance.

They have all the features of the larger Cincinnati Press Brakes, and offer productivity, accuracy and versatility with low initial investment.

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THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

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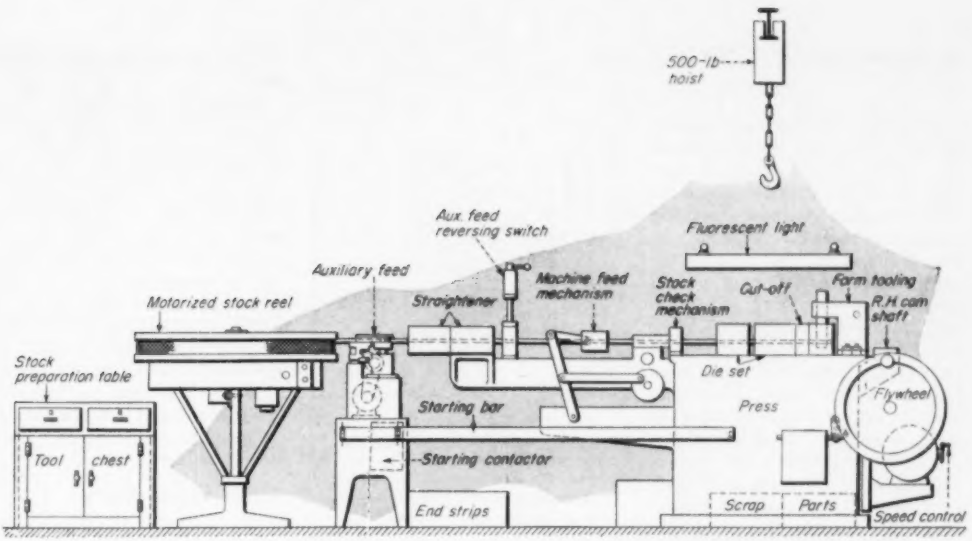
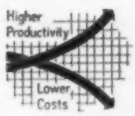


Multiple-slide press layout is carefully planned to provide good working conditions. At high speed, stock runs out so quickly that press will wait for operator unless manual operations can be performed swiftly and easily. Coiled stock is prepared on tool chest while press is operating and, after press stops, is moved directly into stock reel. Special motorized reel plus adjacent auxiliary feed mechanism relieve operator of much work in loading and operating press. Starting bar of feed mechanism is located for operation by pressure of operator's leg and nearby auxiliary feed reversing switch permits reversing the mechanism in event of an obstruction in threading strip through tooling. For fast-operation work, tools and gages are prepositioned and good lighting is essential. Hoist eases handling of heavy dies

HOW TO BOOST THE OUTPUT OF MULTIPLE-SLIDE PRESSES



PART I...TOOLING DETAILS

BY OTTO C. HELD
Production Engineer, Queens, N. Y.

Press speeds can be increased 50 to 100% by providing proper tooling, adequate auxiliary equipment, suitable control devices and planned operating methods... This article explains what must be done to adapt tooling to high-speed operation

MULTIPLE-SLIDE presses are inherently high-production machines. Yet, oftentimes, their output can be doubled by improvements in over-all machine setup and operating methods. Better still, many of these improvements are applicable to all multiple-slide work. Taking a U.S. Tool No. 33 machine as an example, major improvements will be explained in sufficient detail that they may be adapted to any machine.

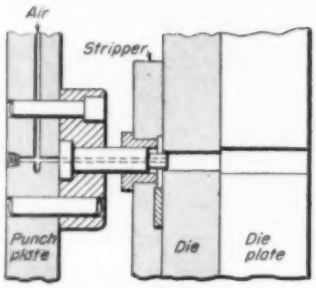
Once it has been decided to improve a setup, a careful analysis of the job must be made. Over-all objectives are: (1) to show an appreciable reduction in operating cost after amortizing the cost of all changes within a specified period of time, (2) to improve the quality of the finished part, and (3) to improve operating conditions and reduce operator fatigue. And for every change, the purpose must be accomplished at minimum cost.

During the analysis, efforts to attain greater production involve several specific items. First, tooling must be changed to permit a shorter cycle time on the press. Tools that run at high speed are subject to more wear and tear and must stand up under higher impact stresses than those that

operate at conventional speeds. Second, working conditions must be improved so operators can keep up to the machine at its increased speed without exerting themselves more than they did under the old setup. This requires the design and installation of special auxiliary devices, such as motorized stock reels and feeding rolls, to relieve the operators of some of the physical labor involved in running the press. Third, everything possible must be done to keep the machine running the greatest part of the day. Switches and control circuits must be planned to give full protecton against tool smashups; steps must be taken to lengthen the time between grinds and to facilitate realigning of tooling; operator's duties must be streamlined by motion study and his efforts stimulated by an incentive payment plan that encourages the elimination of "down" time. From the over-all point of view, every detail of the setup must be studied so the best possible operating conditions can be provided. In this article, attention is focused on the first major item—tooling.

Reinforced Punches

For high-speed operation, punches should be sturdier to stand up under the higher stresses that are created by the increased speed. At the same time, more than usual care must be exercised to avoid hardening cracks. This requires the careful selection of a proper tool steel and of a suitable hardening process, the correct proportioning of tool sections, and the avoidance of all sharp corners. Heat-treatment in a controlled-atmosphere furnace is highly recommended to prevent scale, warpage, and hardening cracks. Punches may have to penetrate dies slightly deeper and should be proportioned so the reinforced section is still in contact with stripper bushing when the tip of the punch is withdrawn from the strip.



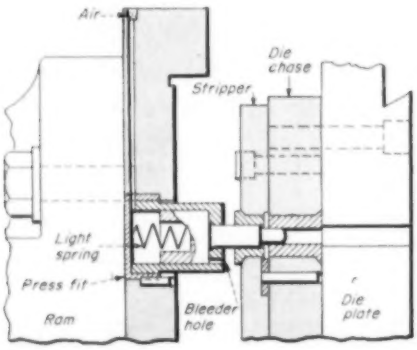
Round punch is reinforced for high-speed work. Shank diameter is increased to raise fatigue limit and to prevent punch from carrying particles of material into stripper-plate bushing

Designing the punch with the shank larger than the tip also helps in avoiding tool trouble. Punches, as they come out of the strip, may carry small particles of metal on their surface. If these particles build up in the stripper bushing, friction and heat increase, resulting in expansion and the possible freezing of the bushing on the punch. The bushing then may be pulled from the stripper plate, with the possibility of tool breakage as a result. The same is true as regards pilots, and they too should be designed with shanks heavier than tip to avoid this possibility.

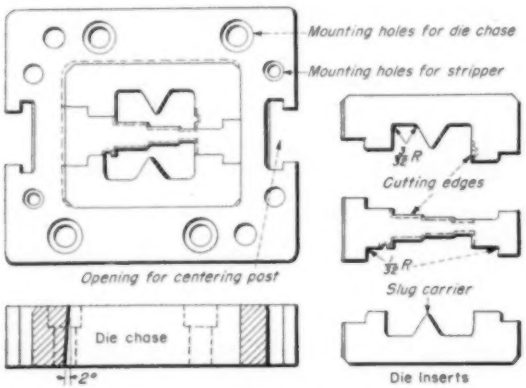
Air-Cushioned Pilots

The design of pilots also should be changed to provide an extreme amount of resilience. Pilots should be spring- or air-cushioned so they will not puncture the stock during a misfeed, but will only dent it slightly. The air-cushioned pilot shown in the accompanying sketch consists of ground parts pressed together, and the assembly itself is a press fit in the punch plate. The locating pin prevents rotation of the assembly and insures that there will be no interruption in the flow of air for this reason.

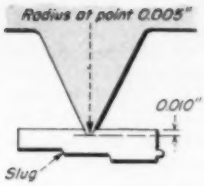
Cut-off punches should be altered to withstand the shock of cutting the full width of the stock strip, rather than simply a notched-



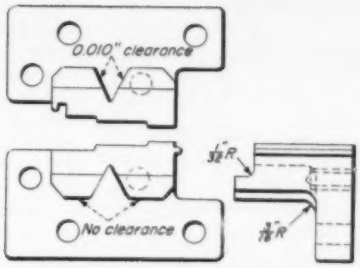
Air-cushioned pilot employs air at 90 psi to provide full cushioning effect. Light spring only holds pilot in forward position when air is not on. Bleeder prevents vacuum or back pressure



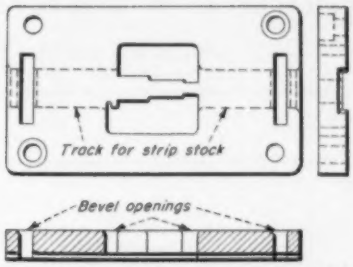
Interlocked die sections, held in place in beveled die chase, cost less initially and wear longer before grinding is required. Draft on cutting edges should be 0.002 to 0.003 in. and clearance between punch and die should be from 0.001 to 0.002 in. Die chase is not hardened



Slug carrier must have dull tip that does not cut into slug. Punch enters die about 1/32 in. to position slug positively on carrier



Punches are shown in conventional inverted position. No clearance is allowed at heel but 0.010 in. is specified on each side of slug carrier



Stripper plate is designed with 0.001 to 0.003 in. clearance for punches. All openings equal to full width of strip must be beveled

down section. Normally, of course, the punch will cut at the reduced section, but if a misfeed occurs, the punch must cut off the full strip. Thus, the added strength is insurance against a tool smashup.

Dies must be designed to hold and carry slugs without fail. Disposal of slugs in horizontal press operations is extremely important to avoid tool breakage. Slug carriers, such as the one shown, may have to be added or changed. Furthermore, compressed air conditions can be provided so air will flow through small holes in the punches to help force slugs through the dies. Air blasts can be controlled by cam-operated or microswitch operated solenoid air valves. It should be remembered that a short staccato blast carries greater impact and requires less air than a steady flow. This also applies to air ejection of finished parts.

High-Speed Ejectors

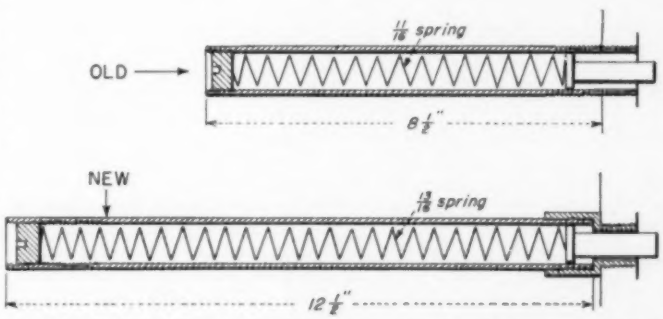
When spring-loaded ejectors are used on high-speed jobs, the spring may be required to throw out the finished part twice as fast and twice as often as in the old setup. Therefore, springs must be of larger wire size, greater outside diameter, and increased length to provide a greater fatigue limit and to speed up the ejection. For example, the improved ejector shown has a square wire spring 13/16 in. OD by 12 in. long and ejects parts at the rate of 142 pieces per minute. This replaced an 11/16-in. OD spring, 8 in. long, that operated at 75 pieces per minute. The same hardened steel ejector is employed and the adaptor bushing carries the same thread specification as the previous ejector. A seamless tube with a fine machine thread contains the larger spring and the weight of the new unit is no more than that of the old.

Inserted cutting tools and form details are excellent to reduce tool-maintenance cost and thus assume added importance in high-speed operation where more rapid tool wear must be expected. It is seldom necessary to use inserts for an entire form but it is advisable to provide inserts for those sections in which the form is delicate and must be made to close tolerances. In designing these tools, extreme care should be exercised in proportioning to avoid premature wear and breakage. The tool block is a developed form and thus is an expensive part. Generous radii must be provided to prevent formation of hardening cracks. In working out the key arrangement, the main objective is obtain a center piece in a form that is easy to duplicate.

Reduced Maintenance

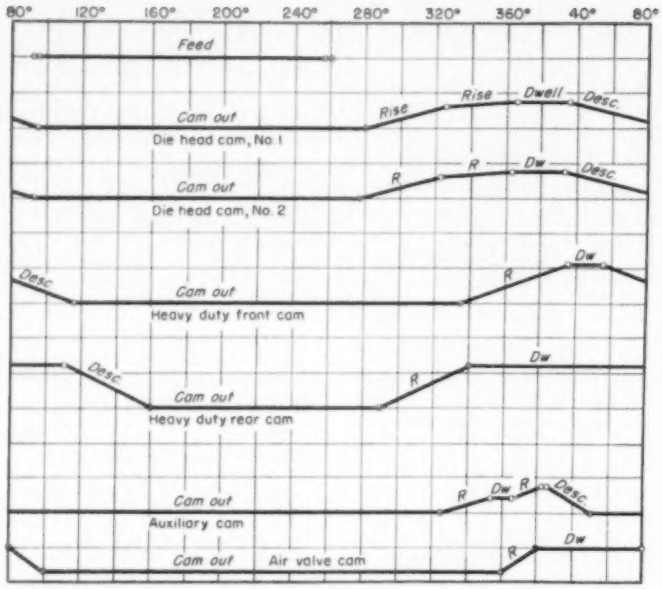
Each die should be made in sections, properly interlocked, and then inserted in a heavy steel plate or "die chase." Sections can be planned so the forms can be ground by machine, thus eliminating hand filing. In this way, "draft" at the cutting edges, as well as clearances, can be held to greater precision. Lower initial cost and longer time periods between grinds thus are obtained. For delicate shapes, it may pay to have special form cutters for both punches and dies. Forms can be milled and, if hardened in a controlled-atmosphere furnace, will require only a hand stoning operation to finish them. Parts then are interchangeable and can be made up in lots for storage as spare details.

On high-production jobs, three



Spring ejector requires longer heavier spring for fast-cycle operation. Threaded adapter permits mounting new ejector on same tool block as old

CAM CHART SHOWS TIMING OF PRESS OPERATIONS



Time and cam chart is based on one revolution of cam shaft. Characteristics of each cam are plotted against 360° scale

sets of tools should be provided. While one set is producing, the second is ready for instant use, and the third is being overhauled. In this way, production delays caused by major breakdowns are minimized and rush jobs in the tool room are avoided.

In addition, all tool details should be listed. Those that are subject to high wear should be made up in large lots and held in the crib as spare parts. When spare details are available, it is not always necessary to remove a set of tools when a mishap occurs. Many times a new part will permit continued production with the same die set. However, when the defective detail is located with other elements on the same tool block, it is sometimes difficult to realign all parts quickly. If these groups are made up and stored as subassemblies considerable replacement time can be saved.

Time and Cam Chart

As multiple-slide tools consist of a variety of elements lined up progressively to run through a cycle in a predetermined sequence, the layout often is complex. Therefor, a thorough study of the new tooling must be made before the actual design is attempted. This study represents a preliminary layout of all tooling and fixtures required for the job. The purpose of the study is to clear up all major problems and to develop the various elements sufficiently to show that they will perform satisfactorily and can be made and maintained at a reasonable cost. In connection with this phase of the project, a preliminary time and cam chart should be made to indicate clearly the action of all tool elements within the time cycle of one machine revolution. The timing and form of all cams also should be shown.

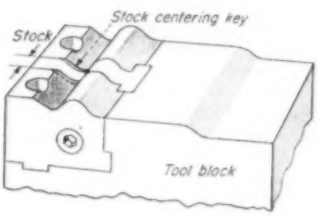
To hold down the cost of new tooling, the engineer should specify cams that are standard with the manufacturer of the press. For each standard the manufacturer has templets so any number of new cams can be ground accurately at reasonable cost. Lists of standard cams are obtained without trouble.

If tools are procured from an outside supplier, copies of the tool studies and the charts should be forwarded to the supplier. And if the user manufactures his own tooling, they should be sent to the press manufacturer with an order for all cams, die sets, rear slides, mechanical air valves, auxiliary feed, stock reel, and any other standard equipment.

If tooling ordered from an outside supplier is completed at a time when the operating company has no machine available for mounting and tryout of the tooling, the tryout may be made in the plant of the tool manufacturer. In this case, it is good practice to dispatch a tool inspector to the supplier's shop to examine the new tooling minutely and make sure that it is in accordance with drawing specifications. Simultaneously the production engineer should request issuance of an order for about 75,000 parts to be made by the supplier, and the forwarding of sufficient material to the supplier. The tool inspector should remain in the supplier's shop until all parts are made then write a report to the chief of tool and part inspection. The latter should distribute copies of this report to the production engineer and to the purchasing agent. Upon approval by the inspection and engineering departments, tooling and parts should be accepted.

Reward Suggestions

In making his analysis, the engineer should draw upon every source of good ideas. Discussions



Inserted form tool permits ready replacement of that section of the form in which wear is greatest. Side inserts project beyond center section to provide guiding effect to strip

with supervisors and operators often bring out many valuable suggestions. If an operator's idea is adopted, he should be given 10% of the net first-year savings resulting directly from the suggestion. And, even if no contribution is forthcoming, a full explanation of what is planned and why it should be done, will pay off in good will and cooperation.

It is very important to follow the sequence mentioned if expenditures for tooling are to be held to a minimum and costly development charges are to be avoided. First, a careful tool study must be made. This results in preliminary layouts that form the cornerstone of the tool planning. If discussions with designers and outside suppliers are made around the study, everyone knows what is required. Second, adequate tryouts should be conducted, results closely followed, and full approval of the engineering and inspection departments be obtained before tools are accepted. Third, the project engineer should be fully responsible to see that action is forthcoming from those people who are properly responsible in the organization. Many times projects have failed to realize their estimated savings primarily because mistakes were made and needless expenses incurred that could have been avoided if the project had proceeded according to the steps outlined.

(Part II of this series will appear in a forthcoming issue.—Ed.)

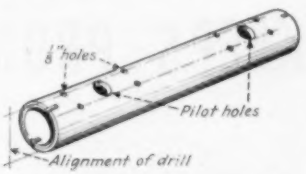
Drillhead-Jig Combination Drills Rocker-Arm Shafts

BY BEN C. BROSHEER, Associate Editor

FOUR ROWS of four $\frac{1}{8}$-in. holes each are required in rocker-arm shafts for John Deere tractor engines. To insure accuracy with a low-cost tooling setup, a 4-spindle Hoefer drillhead was mounted on an Avey drillpress. The jig section of the tooling fixture was fixed to the drillhead, which provided a compact, easily operated device for performing the operation.

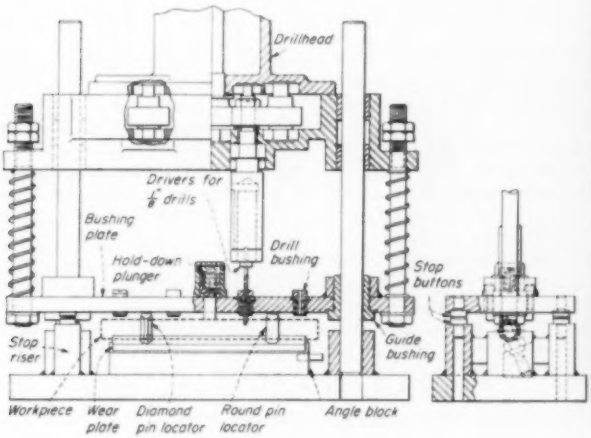
Each row of holes in the shaft is offset from the axis of the two larger 15/32-in. holes by 20°, so an angle block was located under the bushing plate and was fitted with two pin locators at a 20° angle from the vertical. The shaft is located on the pins for one row of holes, power feed is engaged to operate the drills, and a spring-loaded plunger in the jig contacts the workpiece to hold it down. After the first cycle, the work is rotated 180° and set back in the fixture. For the third cycle the work is reversed from left to right, and for the fourth cycle it is rotated 180° again.

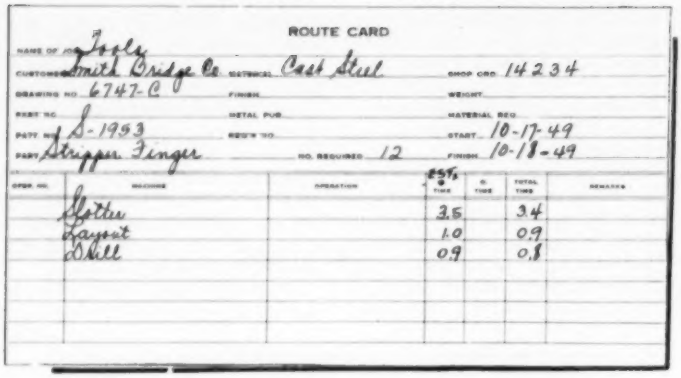
The bushing plate is attached to the drillhead through two guide posts fixed to the fixture base and two support rods fitted with compression springs. Steel stop buttons on four risers on the base are contacted by buttons on the bushing plate to limit motion.



Welded-steel tubing forms shaft. Centerless grinding to 0.8105-0.8100 in. precedes drilling large hole and slotting ends. Small holes are drilled last

Drillhead fixture is at left spindle of drillpress. Other two spindles can be set up for other jobs, watched by same operator. Cycling is automatic. Two pins through wear plate on fixture base locate hollow shaft so ¼-in. holes will be drilled 20° off axis of larger holes



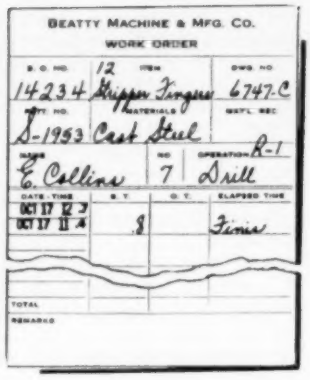


ROUTE CARD

NAME OF PURCHASER: Tooley
CUSTOMER: Small Bridge Co. MATERIAL: Cast Steel SHOP ORD. 14234
DRAWING NO. 6747-C FINISH WEIGHT
PART NO. PATT. NO. S-1953 METAL PUR. MATERIAL REQ.
PART: Stripper Finger REQ'N NO. NO. REQUIRED 12 START 10-17-49 FINISH 10-18-49

OPER. NO.	MACHINE	OPERATION	EST'D SET-UP TIME	EST'D O. TIME	EST'D TOTAL TIME	REMARKS
	Slotter		3.5		3.4	
	Layout		1.0		0.9	
	Drill		0.9		0.8	

Route card is made out for each piece on shop order, shows operation sequence, and is held as master record



BEATTY MACHINE & MFG. CO.
WORK ORDER

B. O. NO.	ITEM	DWG. NO.
14234	Stripper Finger	6747-C
QTY. NO.	MATERIALS	MAT'L. REC
S-1953	Cast Steel	
MAN E. Collins	NO. 7	OPERATION Drill

DATE - TIME	S. T.	O. T.	ELAPSED TIME
Oct 17 12 P			
Oct 17 11 A	.8		Finish
TOTAL			

REMARKS

Work order is written for each operation on yellow route card and goes into scheduling rack

SMALL-SHOP PLAN KEEPS PRODUCTION MOVING

BY L. C. BEATTY, President
Beatty Machine & Manufacturing Co.
Hammond, Indiana

Designed for job-lot manufacture, its major features are:

1 .. Schedules can be changed easily

2 .. Machine loading can be determined quickly

3 .. The progress of all jobs is apparent

4 .. Waiting time is reduced

5 .. Time keeping is accurate

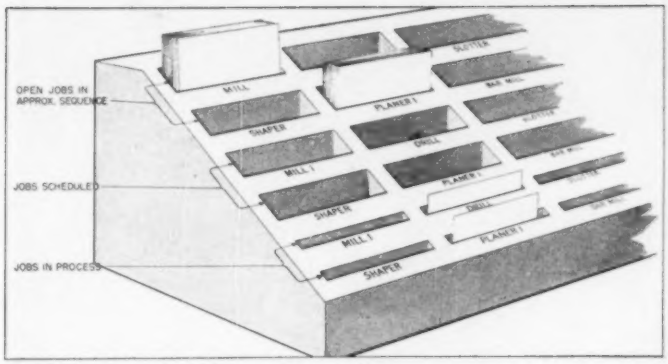
FLEXIBILITY is a major requirement of production control systems, and especially of those that operate in small shops with diversified production. Here, a delay in deliveries, or the scrapping of a casting, can upset a machine loading schedule at a moment's notice. Highly desirable in situations such as these is a system that permits rescheduling without erasing and rewriting. Our system makes this possible—and at the same time, provides accurate progress and cost information and an efficient dispatching procedure.

The heart of the system is in the shop office, where a scheduling rack is maintained, work cards are written and dispatched, drawings and progress sheets are held, and time is recorded. When an order is received, a yellow route card is made out for each piece on the job. The cards list all operations to be performed and generally are written by the shop supervisor. On repeat orders, however, this is done by a shop clerk who refers to past records.

From the route card, the shop clerk makes up a white work order for each operation and also fills out a progress sheet giving a record of all parts on the job. Order and routing information then is added to a heavy, brown manila envelope in which the part drawing is placed. The envelope, route card, and progress sheet go to their respective files, while the work orders go directly into the scheduling rack. All machine loading schedules are made by positioning the cards in this rack.

For each machine, there are three sections or slots in the rack. The "open-jobs" section is for the backlog and contains work orders arranged only approximately in the sequence in which they will be processed. A quick glance at the cards in this section will give a rough idea of the load ahead of each machine tool.

In the "scheduled-jobs" section, cards are in the exact order that the jobs are to run in the machine. Cards move progressively through the slot with the front card being



Scheduling rack has space for work orders ahead of each machine in shop. Scheduling is done by positioning cards in proper section of rack. Cards normally advance through "job-scheduled" slot progressively, but changes in schedule can be made easily

the one for the job that will run next. The sequence in this section, therefore, can be termed the load schedule ahead of each machine tool for a short period of time. Some of the larger machines, of course, can be scheduled for a week or ten days in advance, while on the smaller equipment such as shapers and drills, it is impossible to schedule more than two or three days ahead. Should it suddenly become necessary to revise the schedule becaue of scrapped castings or design changes, it is very easy to shift a card—say from second to fourth position or from eighth to third. The foreman over a given section of the plant can sift through these cards for his department and make changes as required.

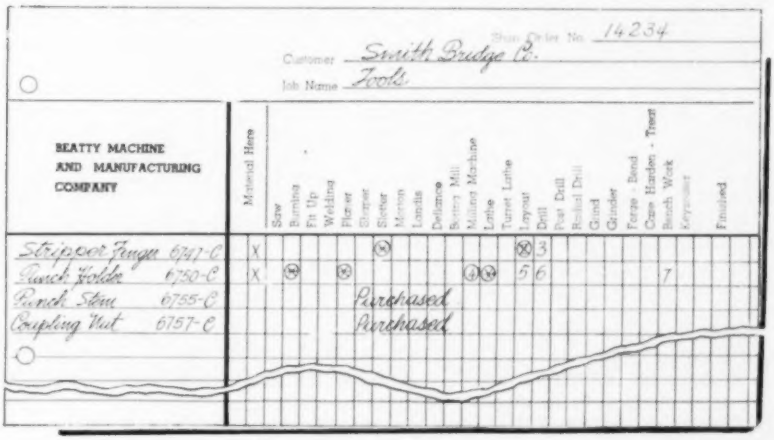
The "jobs-in-process" section carries only one card for each machine tool—the card for the piece currently in operation on the machine.

Dispatching Orders

When an operation is finished, the operator returns with the drawing envelope to the time office and is given the drawing envelope for the next job on the schedule. The time of finishing is stamped on the work order just completed and the starting time is entered on the card now in process. As pieces are completed, the running time on each work order is posted to the route card and the route card is filed as a master record. The work orders are held for approximately 30 days for checking purposes should errors be encountered in posting to yellow route cards. The orders, having served their usefulness, are thrown away.

The progress sheet covering the whole job lists all its individual parts with the order of operations noted across the line so the status of each part can be seen at a glance. This sheet is very valuable to the foreman as he cannot schedule a piece for the milling operation, for example, before it has been completed on the planer. The summary sheet also indicates whether the material is on hand and includes all operations as well as the finished columns. As one of our products is nearing the delivery date, it is very easy to check the finished column and pick up any lagging pieces before the assembly work begins.

Both the progress sheet and the work orders are only for current information while the job is in the shop and are disposed of upon completion of the job. The route cards are filed for future reference. Errors that were made, troubles encountered, or any other information that should be available for repeat orders may be entered on this card. In addition to simplifying the task of routing, scheduling, and dispatching work through the shop, this system gives accurate time keeping on all operations.



Progress sheet shows status of each piece on shop order. One sheet is made up for each order. Numbers indicate operation sequence. Circle around number denotes job in machine; cross signifies that operation has been completed

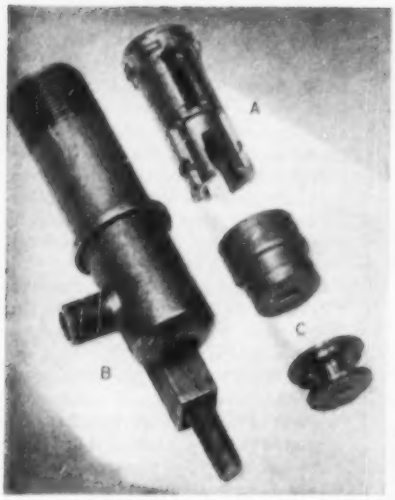


Fig. 1 ... Die-castings, machining of which is described, include lock cylinder **A**, antenna support **B**, and plunger cap **C** as it appears before and after machining

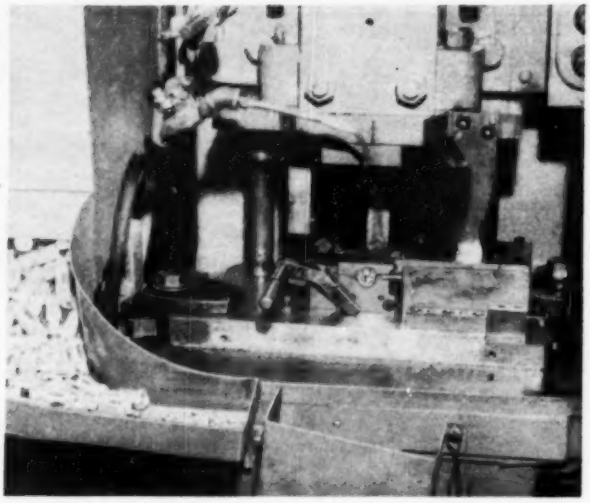


Fig. 2 ... Broaches attached to ram and on slide operated by cam from press ram remove flash from cored holes in lock cylinders

FAST SETUPS FOR MACHINING SMALL DIE CASTINGS

The economies of die casting are retained for these small parts by tooling that combines machining operations and provides fast, easy loading

BY HERBERT CHASE

DIE casting is a fast, economical method of producing many types of small parts in large quantity. But when flash must be removed or other machining performed, this saving will be lost unless the tooling handles the quantities involved in fast, simple fashion. Here is how Rochester Products Division of General Motors handles typical small die castings to get these results.

In lock cylinders, most holes are cored, sometimes from three or more directions. Where cores intersect or meet, as in the case of tumbler holes and side holes, all radial, flash is left at the junctions and must be removed. For the cylinder shown at *A* in Fig. 1, there are six radially cored tumbler holes with walls only a few thousandths thick between holes. These join a side hole 90° around the cylinder and flash at the junctions has to be removed.

This is done in a fixture (Fig. 2) which has a hole that fits the diameter of the straight cylindrical portion of the piece. When pushed into this hole, the casting is located in correct angular position (with the keyslot vertical) by a pin that fits another cored slot on the back end of the cylinder.

Six vertical broaches are spaced to fit the tumbler slots and clamped together in a holder operated by the press ram. There is also a single horizontal broach that enters from the right side and is cam operated. The end of this broach is serrated and has a projection that enters the lower part of each tumbler slot from the side. As the press closes, the horizontal broach is first advanced by the cam, shearing off flash at its end projections, and at once retracts by cam action.

Immediately thereafter, the six vertically operated broaches enter the cored tumbler slots and clear these slots of flash. In so doing, some flash burrs enter the side holes previously broached so, on

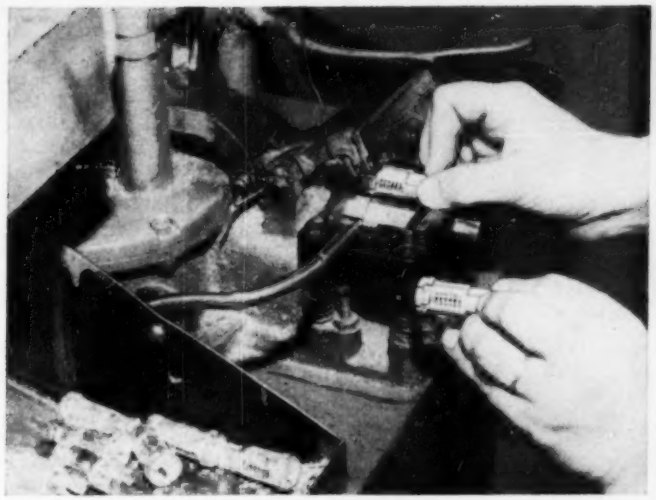


Fig. 3... Flash is removed from bottom of side recess in lock cylinder by a 5-tooth reciprocating file

the upstroke of the ram and after vertical broaches are withdrawn, the horizontal broach makes a second stroke removing burrs left by the vertical broaches. The operator loads each piece, trips the press and then moves a hand ejector lever that pushes the piece out of the fixture. About 1150 pieces are broached per hour. Guards normally used in this setup were removed to photograph the fixture.

Another operation for removing flash in the side bar recess of lock cylinders is done on a filing machine (Fig. 3). Although called a "file", the tool, which is reciprocated rapidly and continuously in a fore-and-aft horizontal motion, is more or less like a broach whose five teeth cut as a result of this motion. All the operator does is to lay the piece in a slot that it fits and hold it down on a seat. When he does so, the file enters the slot in the casting and clears any flash therein. Depth of cut is controlled by the seating of the piece. This rapid, simple operation can be performed by unskilled labor.

Radio antenna holders are cylindrical die castings (*B*, Fig. 1) that require a chased thread on one end and also on a side nipple near the other end. There is also a longitudinal lug that requires a tapped hole parallel to but not in line with the axis of the piece. A short steel stud, threaded over its entire length, has to be screwed firmly into this hole. All these operations are performed in the Kingsbury machine (Fig. 4) after the casting is locked horizontally in a holder on a sliding bed.

After the holder is loaded, it is moved automatically to a rear

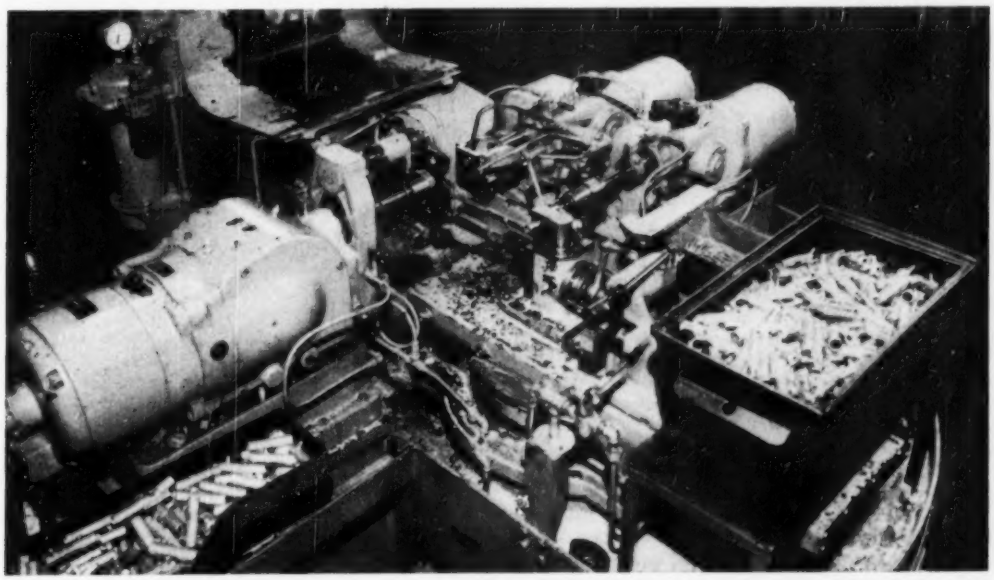


Fig. 4 ... Antenna supports are tapped at two points while a hole is drilled in a lug, tapped, and a stud inserted in the tapped hole

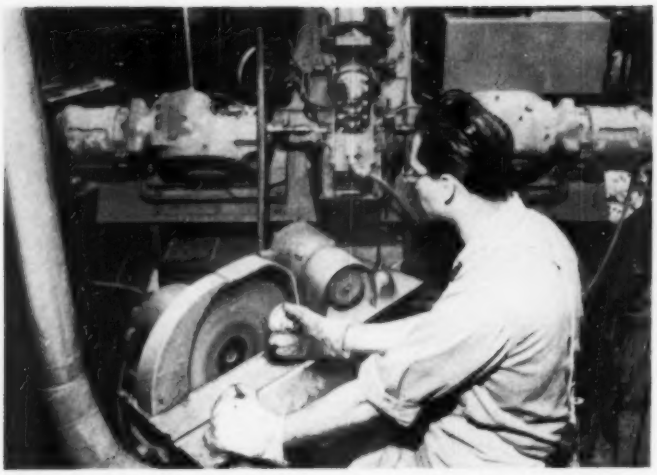


Fig. 5 ... Fuel-pump covers are ground on the face and burnished on the edge, then placed in the loading chute of the tapping machine in the rear

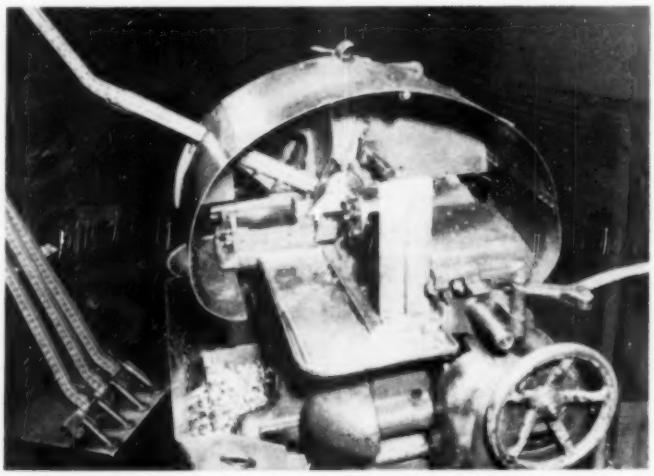


Fig. 6 ... Plunger caps are fed from the removable magazine at left to this automatic screw machine being used as a chucking machine

position where three heads feed in. Two have chasers that thread one end of the piece and the side nipple, then expand and are retracted. At the same time, a hole is drilled in the lug and a fourth spindle picks up the threaded stud from the fifth-position chuck. Finally, the holder shifts into line with this stud-setting spindle and it screws the stud into the drilled hole, then backs off. While this operation proceeds, the operator inserts a stud into the chuck in the fifth position, ready for the next part. With this setup, 400 pieces an hour are completed.

Chevrolet fuel-pump covers include a flange that must have its face ground and the edge of this face burnished, operations performed respectively on the large and small wheels of the machine in the foreground of Fig. 5, with casting held by hand. Upon completion of these rapid operations, the operator slips each casting into a magazine of the Kingsbury machine in the background of Fig. 5. This machine is completely automatic and is equipped with three heads. Those at each side carry one tap each. These feed into holes that are in line with the taps when the piece reaches the bottom of the magazine and is locked automatically. At the same time, two other taps, operated by a head on an incline above the casting are fed in and tap two holes at right angles to the first pair. When the taps retract, the machine unlocks and ejects the piece, another drops into position from the magazine and is locked to start the next cycle. With this rapid setup, the total time per piece, including grinding and tapping operations, is only five seconds. Formerly, this same job required two operators.

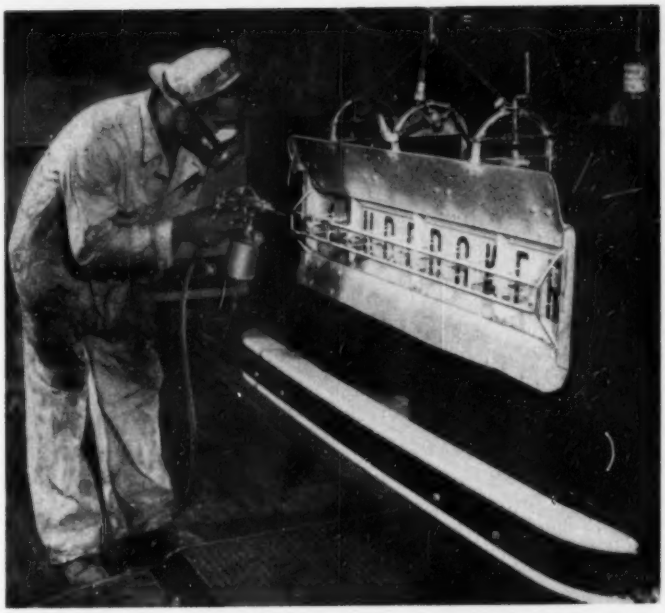
Plunger Caps

Plunger caps (*C*, Fig. 1) are ¾ in. OD and ⅜ in. long. They are diecast partly because an axial hole of oblong section, that is easily cored in die casting, is required through the finished piece. It would be expensive to provide such a hole if the part was cut from bar stock, but the casting is rapidly machined on the outer diameter, then is cut off to length in a screw machine used as a chucker (Fig. 6).

This Brown & Sharpe machine is fed from a partly removable magazine, the removable sections of which are loaded by hand while supported in the holder shown at left in Fig. 6. As each casting reaches the end of the magazine, it is picked off by a hollow turret tool that advances the piece into the spindle collet where it is locked against a stop. A form tool on a cross-slide then is advanced to give the outer half of the piece (which is solid except for the small cored hole at the center) a spool-like shape. Then the piece is cut off leaving a short ring of scrap in the collet. As soon as these tools retract, the ring of scrap is ejected.

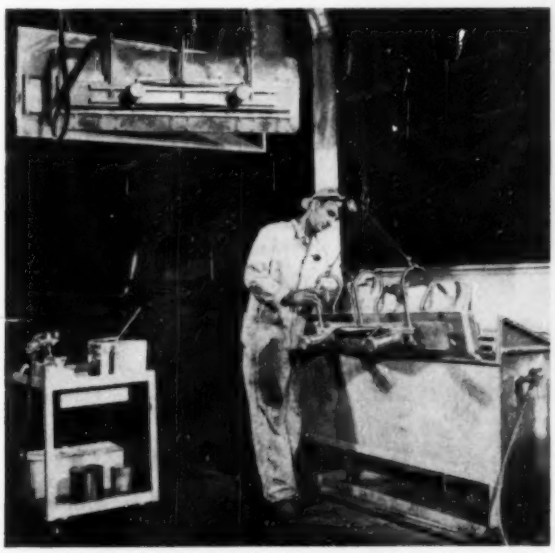
This machine runs automatically, the only labor required being that for setup, for loading the magazines and putting them in place, and for checking occasional pieces. 450 castings an hour are machined.

AIR CLAMPS HOLD PAINT STENCIL

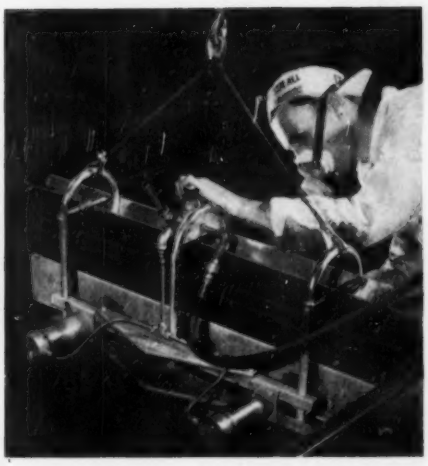


Embossed letters 4¾ in. high on the tailgates of Studebaker trucks are spray coated with white enamel while final adjustments are being made before truck leaves the assembly line. Air-clamped, balanced, metal stencils insure high-quality work and enable operator to keep up with normal output of 25 trucks per hr.

BY A. D. WHITMER
Superintendent, Truck Body & Assembly Div. Studebaker Corp.



Stencils are cleaned after five or six applications by immersing the entire assembly in a tank of denatured ethyl acetate, soaking for several minutes, scrubbing with a fibre brush, and then drying in front of a suction hood. Use of three masks permits one to be in use while the second is soaking and the third drying



Air cylinders controlled from single valve at center clamp stencil to truck tailgate. Quick-acting connector simplifies connecting of air line to mask assembly. Overhead spring balancer on monorail track relieves the operator of heavy lifting. Cylinders are 1¼ in. in dia, 2-in. stroke, and operate on 45 to 50 psi air pressure

SELECTION OF TRANSFER MACHINES FOR MEDIUM-VOLUME PRODUCTION

By RUPERT LE GRAND, Associate Editor

CADILLAC Motor Car Division, General Motors Corporation, makes use of transfer machines in a number of departments, even though it is not a high-volume automobile manufacturer. Post-war output climbed to 90,000 cars in 1949, and a further increase is planned for this year.

In selecting transfer machines, F. M. Prucha, supt., Methods and Equipment Division, must keep in mind required output, costs and plant-layout problems. In the case of the multi-operation cylinder head, assembly needs are 50 pcs pr hr. Choice of one huge transfer to perform all the drilling, tapping, reaming and similar operations would be a case of "putting all the eggs in one basket." For even if the 22-ft. spacing of building columns would permit this step, the chances of tieing up the entire plant in case of a breakdown are too serious to be considered. And it is doubtful that labor savings with a single machine would amount to much compared to several transfer machines, because the former would require more operators and inspectors.

Thus, to secure balanced production and low costs under the circumstances, logical policy was:

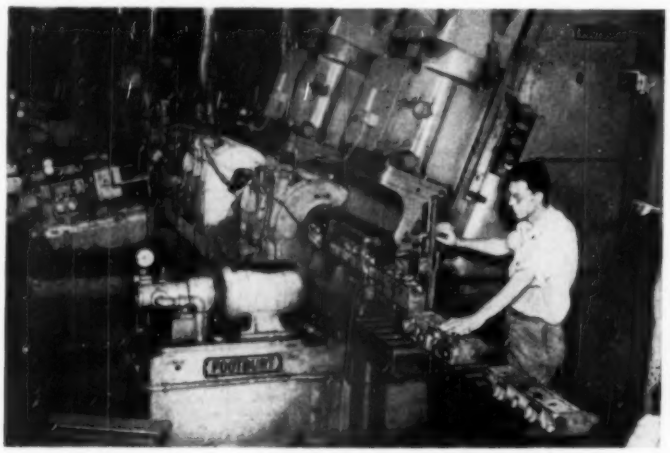
1. Group operations according to (a) type and speed, and (b) accessibility of work faces to the tools without turning the piece sideways or flopping it over while in the machine.

2. Choose transfer machines according to the above analysis, and with proper regard to efficiency of work location, work clamping and tool-head location. Also provide "idle" stations at appropriate points in the machine so that the operator can periodically check the quality of work done at a critical location.

3. Specify replaceable carbide drill bushings, which are a potent source of reducing maintenance, according to Cadillac's experience.

4. Leave room ahead of each machine for a parts bank sufficient to keep the unit running for some time, if another transfer machine happens to be down for tool replacement or repairs.

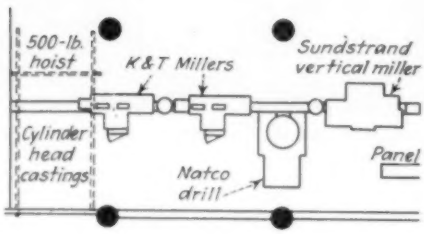
The original planning indicated that three transfer machines, (as shown in the layout below) would give the desired capacity plus a safe margin for breakdowns and increased schedules, satisfactory labor costs and minimum handling. Since then, a fourth machine has been added, because of the engineers' desire to make a quiet engine even more quiet.



First Footburt unit machines combustion chambers and about 50 holes in the cylinder-head casting. Idle stations at strategic locations permit periodic work-quality inspection by operator and also serve as unloading points for chips brought to these positions by conveyors

Method of Location

Cadillac dowels cylinder heads to the block of its V-8 engine. These dowel holes are drilled and reamed before the cylinder heads arrive at the first transfer machine, and the dowel holes are used for



Chance of department shutdown for machine repair is minimized by dividing among three transfer machines the operations upon more than 50 holes in the cylinder head

location purposes at each station of the three transfer machines. By this means all holes are maintained in correct relationship, in a part which definitely requires precision workmanship for correct functioning in the engine.

Simple Transfer Mechanism

Any inaccuracies, such as might be introduced by mounting the workpieces on platens while traversing the transfer machines, are avoided. The transfer mechanism is relatively simple, consisting merely of transfer bars that rock down into position and then push the piece along rails for one station. Hence, once the piece is in a given machine, it progresses straight through without being turned over or around.

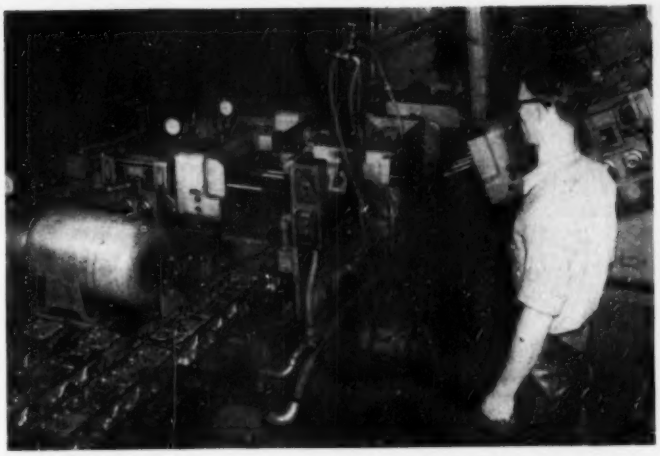
Cylinder heads arrive at the first Footburt transfer machine (10 stations) with all surfacing operations completed, except milling the combustion chambers. The operation sequence is:

Station 1—Load part on edge so that a large number of holes may be drilled by means of horizontal drillheads. If the part is not properly clamped (hydraulically) at any station, a warning signal appears on the control panel.

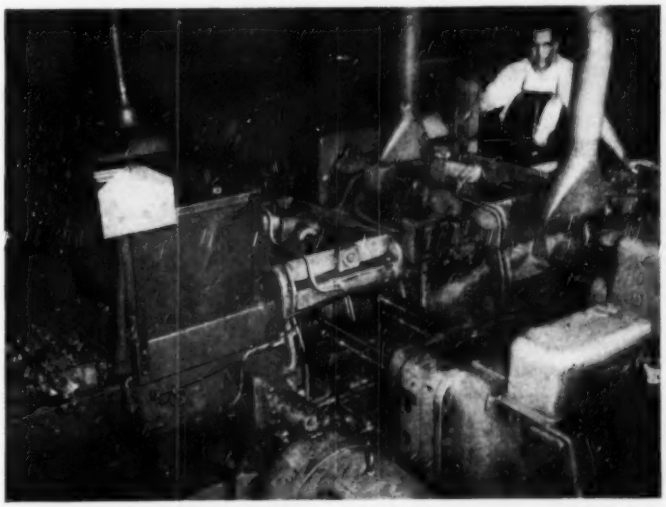
Stations 2 and 3—End-mill combustion chambers. Station 2 handles the first and third chambers; Station 3 the second and fourth chambers, in order to give tool clearance.

Stations 4 to 10—Drill and ream about 50 holes, and unload.

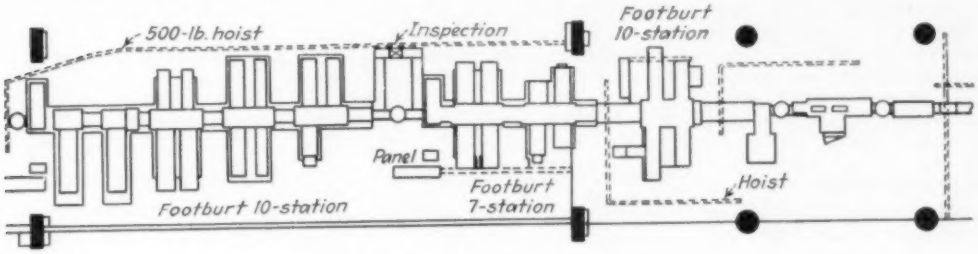
The fourth Footburt, a 10-station machine, is arranged with double indexing for drilling and tapping holes on the ends of right- and left-hand cylinder heads. In this machine the castings move sideways through the machine.



Hydraulic clamping is used at all heads of the Footburt transfer machines. If any part is not properly clamped, a warning signal is shown on a panel behind the operator. Shown: loading end of 7-station machine for miscellaneous drilling and tapping operations



Double indexing of the transfer-bar mechanism is required for the last 10-station Footburt machine so that holes can be drilled and tapped in the ends of right- and left-hand cylinder heads



HOW TO APPLY SCRAP-STRIP ALLOWANCES FOR BLANKING DIES

Rules worked out from practice with one-pass and double-pass layouts enable the die designer to give the scrap strip proper strength without material waste

BY J. R. PAQUIN, Tool Engineer
UNDERWOOD CORPORATION

FROM the economy standpoint, and for successful die performance, it is important that correct scrap-strip allowances be applied to the material layout (see *AM*—Dec. 15, p.). Too great an allowance is wasteful of material on long runs. On the other hand, insufficient stock between blanks, and between the blank and strip edge, will make the scrap-strip weak and subject to breakage, and hence slow down press operation. A weak scrap area around the blank can also bring about severe dishing of the part.

Curved-Outline Blanks

Piece-part peripheries fall under several distinct outline shapes. The most common is the curved outline, Fig. 1. Where curves on adjacent blanks are opposite, or the curve on one part is adjacent to a straight line on the next one, the correct allowance is 70% of the strip thickness for "one-pass" layouts. In Fig. 1, all dimensions *A* fall in this classification, and they are made 70% of the material thickness, or as close to it as possible, consistent with the application of a commercial dimension to the center-to-center distance *B* and strip width *C*.

Straight-Sided Blanks

The blanks in Fig. 2 have straight sides adjacent to each other and to the outside edges of the strip. For one-pass layouts, if the straight portion of the blank outline is shorter in length than 2½ in., apply one thickness of stock as the scrap-strip allowance *A*.

Where the extent of the straight edge is from 2½ to 8 in., apply 1¼ times the material thickness as the scrap-strip allowance *A*; if blank length is greater than 8 in., apply a scrap-strip allowance of 1½ times the material thickness.

Parallel Curves

In making a material layout it is often found that the edges of some parts form parallel curves, as shown in Fig. 3. These are treated in the same manner as straight edges, Fig. 2, and the same rules apply. Dimension *A* in Fig. 3 should equal one material thickness if part length is less than 2½ in.; If it is from 2½ to 8 in., the allowance is 1¼ times the material thickness; but if it is over 8 in. long, the allowance is 1½ times the strip thickness. Dimension *B*, on the other hand, follows the rule for parts with curved outlines as given in Fig. 1, and is 70% of the strip thickness.

Adjacent Sharp Corners

Sharp corners form a focal point for fractures and should be given considerable allowances. In Fig. 4, dimensions *A* should be 1¼ times the strip thickness, at least, for one-pass layouts. This allowance should be enough to withstand the most severe operating conditions without breakage.

Double-Pass Layouts

Where the strip must be passed through the die twice in order to remove all the blanks from it, as shown in Fig. 5, and the blanks are arranged in a single row, the scrap-strip allowance should be 1½ times the stock thickness, at least. Blanking the first row of parts distorts the strip. Hence the specified allowance is necessary so that enough material will be left for cutting full blanks on the second pass.

SCRAP-STRIP ALLOWANCES FOR ONE-PASS LAYOUTS

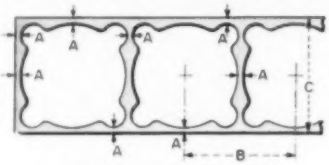


Fig. 1.. For work with curved outlines, dimensions A = 70% of strip thickness T

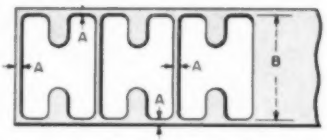


Fig. 2.. For straight-edge blanks:
Where B is less than 2½ in., $A = 1\ T$
Where B is 2½ to 8 in., $A = 1¼\ T$
Where B is over 8 in., $A = 1½\ T$

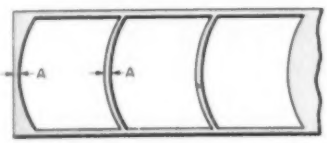


Fig. 3.. For work with parallel curves, the same rules for A apply as in Fig. 2, and B = 70% T

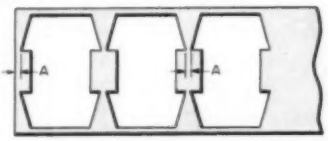


Fig. 4.. For layouts with sharp corners of blanks adjacent, A = 1¼ T

SCRAP-STRIP ALLOWANCES FOR TWO-PASS LAYOUTS

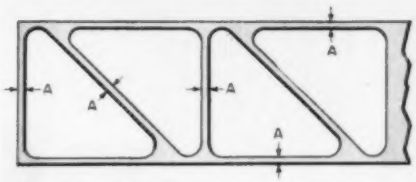


Fig. 5.. Single-row layout intended for two passes through die: $A = 1\frac{1}{2}\ T$

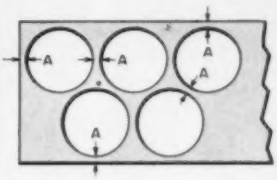


Fig. 6.. Double-row layout of blanks with curved outlines: $A = 1\frac{1}{4}\ T$.

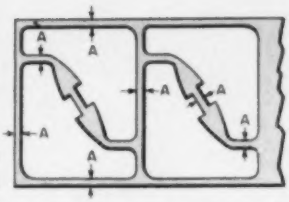
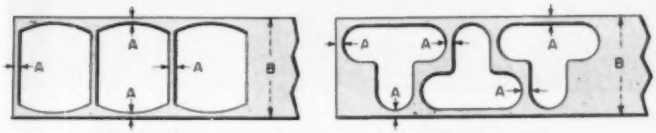


Fig 7.. Double-row layout of parts with straight and curved outlines: $A = 1\frac{1}{4}\ T$

MINIMUM SCRAP-STRIP ALLOWANCES



ONE-PASS LAYOUT

Strip Width B	Space A
0 to 3 in.	1/32 in.
3 to 6 in.	1/16 in.
6 to 12 in.	3/32 in.
Over 12 in.	1/8 in.

DOUBLE-PASS LAYOUT

Strip Width B	Space A
0 to 3 in.	1/16 in.
3 to 6 in.	3/32 in.
6 to 12 in.	1/8 in.
Over 12 in.	5/32 in.

Fig. 8 and 9.. For thin gages of stock, the preceding rules do not apply, and minimum scrap-strip allowances should be selected from the tables

TWO APPLICATIONS OF RULES FOR ALLOWANCES

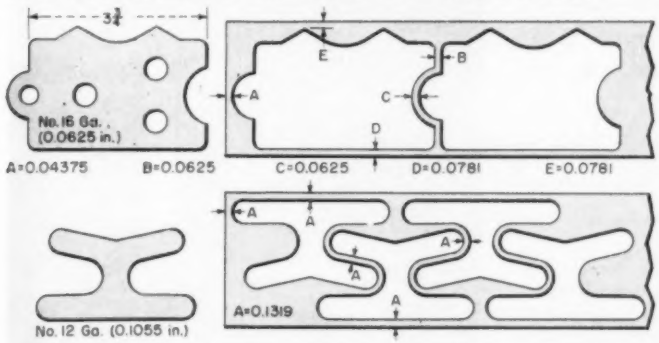


Fig. 10.. Applications of rules for scrap-strip allowances are outlined for two methods: *above*—single-row, one pass through the die, and *below*—double-row, two passes through the die

Where piece-parts are arranged in the strip in two rows, as shown in Figs. 6 and 7, allow $1\frac{1}{4}$ times the material thickness as the scrap-strip allowance A for blanks with both curved and straight outlines. The wider strip does not distort as much in cutting the first row, and slightly less scrap-strip allowance is required. Due to this minimum distortion of the strip, double-row layouts are preferred wherever they can be used.

Minimum Allowances

Tables in Figs. 8 and 9 give minimum scrap-strip allowances for both one-pass and double-pass layouts. These will apply to the thinner gages of stock, where use of the previous rules would give such a small allowance as to be impractical.

Application of Allowances

The use of the rules given will be made clear in the application of the correct scrap-strip allowances to the typical piece-part at upper left in Fig. 10. A one-pass layout as seen at the upper right is suitable. Dimension A is applied by use of the rule given for Fig. 1, and is 70% of the strip thickness, or 0.0437 in. At B there is a short, straight portion of the outline and, as explained for Fig. 2, it is made the same as the stock thickness, or 0.0625 in. Space between the parallel curves at C follows the same rule, and is also 0.0625 in. If C had been longer than $2\frac{1}{2}$ in., the space would have been made $1\frac{1}{4}$ times the stock thickness. And B would then have had to be given the same dimension.

The extended straight portion of the part outline is between $2\frac{1}{2}$ and 8 in. Hence space D is $1\frac{1}{4}$ times the stock thickness, or 0.0781 in. To the sharp corners of the piece-part must be applied the rule given for Fig. 4. Allowance E therefore is $1\frac{1}{4}$ times the stock thickness, or 0.0781 in.

The piece-part illustrated at the lower left of Fig. 10 is shown laid out for double-row, double-pass blanking, as at right. Following the rule given in Figs. 6 and 7, for blanking two rows of parts, all the scrap-strip allowances A are given as $1\frac{1}{4}$ times the material thickness, or 0.1319 in.

OLD METHOD of loading was to pile farm implement disks on edge by hand. Five to seven men worked a full 8-hour day to load or unload one box car. Disks required costly 2x8-in. bracing secured to sides of cars and held in place by wood bulkheads

NEW METHOD is to bolt disk stack through center with part of disks reversed in stack; opening between concave and convex disk surfaces permits entry of lift-truck forks. Box car now can be loaded or unloaded in approximately 40 min

Trucks Slash Handling Costs On Curved Disks

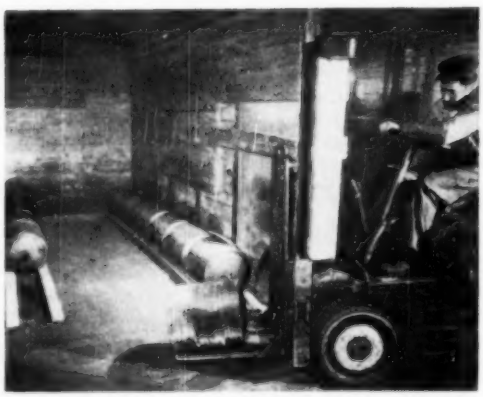
New method cuts car loading time from 40 manhours to 40 minutes

BY HENRY M. PRATT,
General Traffic Manager
CRUCIBLE STEEL COMPANY OF AMERICA

LARGE increases in productivity often result from mechanizing handling operations. But seldom is the gain as great as that obtained from the application of power lift trucks to the loading of curved disks into box cars at Crucible Steel's Midland plant. One man with a truck now does in 40 minutes what formerly required 40 manhours of manual effort.

The new method applies to finished disks for agricultural implements. After the last operation, disks are stacked for movement to the shipping department and loading into the car. Disks more than 18 in. in diameter are arranged in a stack that is handled and shipped in the vertical position. Disks less than 18 in. in diameter, however, are easier to handle horizontally. Weighing up to 300 lb, stacks are moved and positioned with ease by truck.

In addition to great reductions in labor costs, the new method shows appreciable indirect savings. The stacking procedure provides a more stable load in the car and has eliminated all loss from damage to disks in transit. This not only eliminates an economic waste but also helps to create customer good will through the delivery in satisfactory condition of the full number of pieces ordered.



SECOND NEW METHOD applies to disks less than 18 in. in diameter. Stack has no gap and is cradled horizontally between forks of truck. Longitudinal 2x4's prevent shifting of stack in transit

HOW TO WORK

CLAD MATERIALS

BY WM. M. STOCKER, JR.
Assistant Editor

CLAD MATERIALS provide a means for cost saving and conservation. Optimists feel that in ten years the industry should be producing 1,000,000 tons a year, at an estimated value of $600,000,000. Output has more than doubled since 1946, for a total upwards of 23,000 tons today. Clad offers advantages that may well make these dreams come true.

As an art, the cladding of metals was known in the early 1700's in England. Sheffield plate was made by pressing silver and copper together until they bonded. Then the art was lost for many years — to return as an industry.

Today, clad is found wherever corrosion resistance, or high thermal conductivity coupled with corrosion resistance, is needed. It provides a protective anti-corrosive outer layer, of just sufficient weight for the desired properties, over a backing or core of structurally strong, thermally efficient, or less-expensive material. Large savings result from limited use of valuable alloy, while other core materials provide maximum heat efficiency, or strength, with minimum corrosion. Also, the conservation aspect is important to the national stockpile of raw materials—particularly in time of war.

Clad is not difficult to work, requires only care and routine experience. Most operations follow the standard procedures used for solid materials. Here latest fabricating practice is summarized (with emphasis on welding, because of lesser knowledge of that procedure) including. . . . .

1. **What Clad Is**
2. **Handling**
3. **Cutting**
4. **Welding**
5. **Machining**
6. **Hot Working**
7. **Shearing and Punching**
8. **Bending and Rolling**
9. **Drawing, Spinning**
10. **Heat Treatment**
11. **Finishing**
12. **Non-destructive Testing**

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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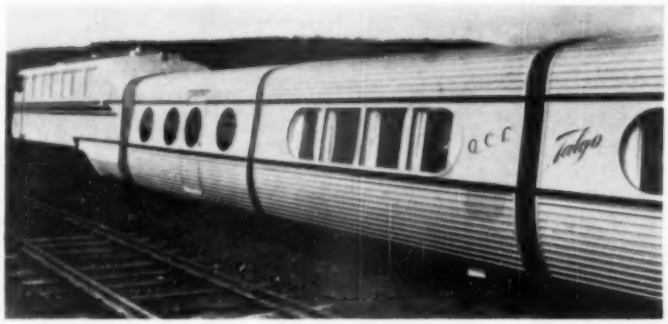
What Is Clad?

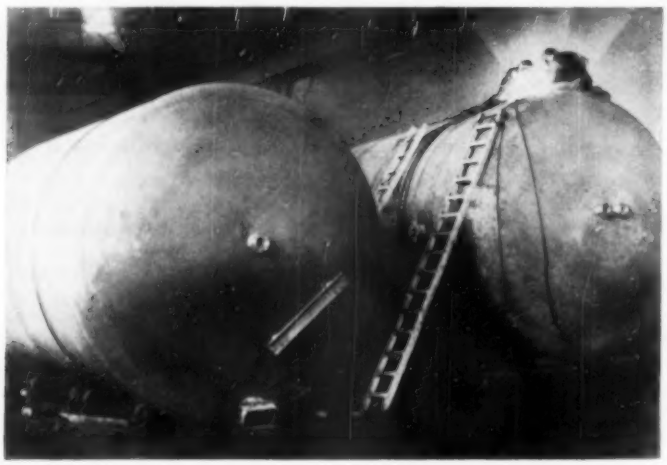
ANY composite sheet or plate having two dissimilar metal sheets inseparably and uniformly bonded is considered a clad material.* Adhesive is seldom used in the preparation as the bond between the plates is usually molecular. The metal provided for required surface characteristics in clad plates is considerably heavier than most plating; has a structure characteristic of rolled or wrought metal, hence the plated or dipped coatings are not true clad metals.

Clad-materials provide economical, corrosion-resistant plates for use in the fabrication of large vessels, tanks, agitators, and heat exchangers, also bumpers, plus much other equipment, at lower cost. Lighter gages find use in cooking utensils for home, restaurant, or cannery. Light alloys clad with pure aluminum, other alloys, or with magnesium are well known to the aircraft, railroad, and appliance industries. Generally speaking, clad may be said to fall into three groups: ferrous, non-ferrous, and precious metals. The latter, bonded to brass or nickel, are used in plateware and chemical utensils.

* For the purpose of this report, "sheet" and "plate" will be used interchangeably, as technique varies little between them.



Aluminum-clad permits use of high-strength aluminum alloy, protected from corrosion by pure aluminum, in the new Talgo train. Lightness provides power economy, plus rapid acceleration and stopping for commuter or feeder service



Clad steel pressure vessels being fabricated in accordance with paragraph U-69 of the Boiler Code. 40 ft long by 13 ft dia, clad material is stainless type 316 with 0.03% max. carbon

Making Clad

Component metal slabs are selected for size to provide the necessary ratio of cladding to core in the finished plate. There is a direct proportion between the slab thickness in the assembly and the percent of cladding in the end product. Then each individual component is processed by cleaning the surfaces to be bonded, and, if stainless or Inconel, by electrolytic nickel or copper plating. Rapid oxidation of stainless steel and Inconel prevent direct bonding to steel, thus plating provides the surface necessary to a good bond. Most other metals need no surface treatment other than thorough cleaning.

After components are processed, they are assembled in a pack or "sandwich." A plate of the cladding material, with one surface specially prepared, is placed on a slab of core material. Then the exposed surface of the cladding material is coated with an infusible parting compound and a second, similar assembly of core and cladding material is inverted on top, clad-to-clad, of the first. Core plates are made slightly longer and wider than cladding plates so that, after the sandwich is formed, a groove is created around the four sides of the assembly. Bars are placed in these grooves as fill to permit automatic welding. Then the pack is sealed by welding, thereby preventing contamination or movement during subsequent heating and rolling.

Pressure welding fastens cladding to core, just as a clean block of silver left in contact with a clean block of copper at room temperature will, in about four years, create a molecular bond between the two. Modern clad producers use very high temperatures and pressures; reduce time to minutes.

The composite pack is heated to

a high temperature (for steel, 2100-2350 F), then rolled on a mill. Thickness, of the composite material, is reduced uniformly and the cladding is permanently bonded to the core. After rolling, the pack is sheared or flame-cut inside the weld and as close to the clad edges as possible. It is then separated into two clad plates, each of which consists of a backing plate with a layer of clad metal permanently bonded to one side.

Double-clad material is produced in the same general manner, only the assembly of the sandwich differs.

Fabrication

CLAD materials can be worked with very little more effort than the solid cladding material. In some operations the use of clad will improve the workability. You can weld, form, spin, draw, blank, or shear clad materials as readily as you could perform these operations on a solid sheet, by following a few basic rules. Certain early composite metals were poorly bonded and non-uniform in cladding thickness. This caused a poor impression of clad materials in general which still lives in some shops, even though the early faults have long since been eliminated. Today the major difficulties in working with clad are lack of sufficient initial supervision and inconsistent process control. Eliminate these, discuss problems with the producer, and you will be successful in your use of clad.

Handling

Rule No. One for everyone who handles composite materials is this:

Clad Craves Care and Commonsense

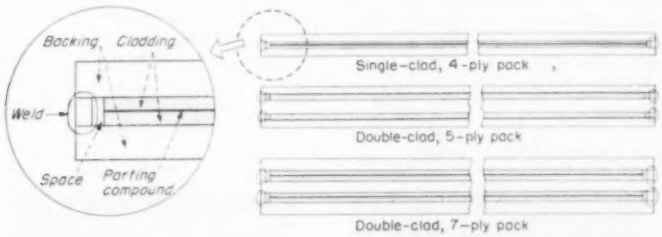
Remember that clad is a valuable material and that it is used for its special properties. Mishandling will lessen its value; make subsequent work more difficult. While in work, the clad surface should always be protected with either adhesive paper or a plastic film, particularly the soft cladding metals.

Are you receiving complaints about rust-spots on recently fabricated stainless clad? Don't worry about the steel analysis until you examine your bending rolls! They should be kept cleaned and polished, as any rust or chips on these rolls will quickly transfer to the clad surface. Also, workmen walking across a clad sheet will track in dirt and chips from the floor. Iron, forced into the surface by these means will rapidly rust—and scare the daylights out of you!

One proud manufacturer of a brand-new fractionating column heatedly called the producer, complained that the silver-clad lining came out of pressure test covered with rust spots. An engineer was immediately dispatched. He found that the steel backing was not coming through the silver, but that small chips of steel had been walked into the soft silver by workers handling the sheets during fabrication. Care would have saved considerable expense.

Remember too, that the cladding usually represents only 10% to 35% of the total thickness. It cannot be ground or polished indefinitely to remove marks and gouges caused by careless handling without destroying its protective qualities.

Stainless-clad copper candy kettle is as fast-cooking as all-copper models. Operation is with 85 psi of steam at 260 F. Welding has eliminated the rivets found inside most all-copper kettles, while the stainless surface provides durability, is cleaner, and corrosion-resistant



Pack assembly may vary in number of plies, according to the product desired after rolling. Procedure, however, is the same in all combinations

Shear-strength test on stainless-clad steel plate specimens, as at left, showed them capable of sustaining over 40,000 psi average. Specimen at right failed at 48,600 psi. ASME Boiler Code and ASTM specs require minimum bond shear strength for clad steels be 20,000 psi

Cutting—Flame and Special Methods

Clad is not flame-cut by successive oxidation as is most solid plate. Instead, the cladding must be removed by the actual melting of the material and the erosion,

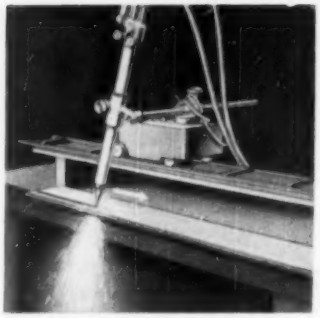
or washing, effect of the stream of slag and oxygen.

Monel-clad and Inconel-clad, if difficult to flame-cut, should be preheated to a dull red ahead of the cut. Nickel-clad, the straight chromium, and chromium-nickel, stainless-clad steel will machine-cut quite readily.

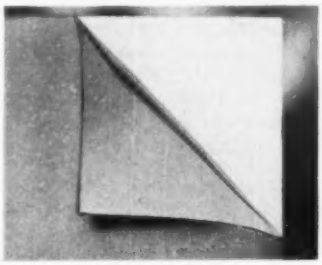
Cut the material, with the backing steel on top, and remove all scale along the line of cut. For thorough and even heating it is recommended that the nozzle be one or two sizes larger than that ordinarily used for the same gage of steel. It should have six, rather than the usual four, preheating orifices. Provide plenty of cutting oxygen to assist in the washing action. Incline the torch 5 to 20° from the vertical toward the direction of cut to aid in producing slag which washes the cladding material away from the line of cut. Differences in fuels and equipment make selection of correct angle of tip strictly a matter of experimentation.

Hold Proper Tip Angle

A tip angle too small will cause flame impingement without penetration of the cladding, while one too large will sometimes result in plates not cut through at completion of cut. Preheating the finished section of the cut to a dull red, will correct the latter. Resort to preheat at the start of all cuts, excepting only 10% cladding, in gages up to and including ¼ in. It is only necessary to preheat these lighter gages locally, at the start, with the cutting tip before commencing the cut. For the heavier gages, and also the lighter gages of 20% cladding, preheat the start of the cut, using a regular torch. Preheat the material to a dull red and be certain, when starting the cut, that the preheating flame does not interfere with the fluxing action of the steel on the cladding.



Flame cutting a stainless-clad plate with an automatic torch feed. Torch is inclined 5° to 20° toward travel



Protection of clad surface is important. Plastic coating will permit shallow draws on prepolished sheets without marring finish. Remove coating adjacent to heat, prior to welding on either side, to prevent burning

Any Clad Can Be Cut

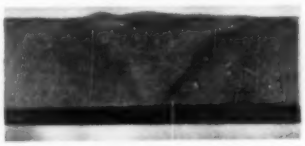
All clad materials may be cleanly and smoothly cut. Only experience will provide the proper relationship between tip size, gas pressure, speed of cutting, plate thickness, and percentage of cladding. These must be based on operating conditions in the shop. Thick plates, or a high percentage of cladding, may be prevented from cracking in the case of straight chromium cladding by preheating before cutting. Speed of cutting and plate gage will determine the extent of the marginal heat-affected area into the plate along the line of cut. Embrittled material should be removed by grinding or machining, if the plate cannot be subsequently annealed, to improve the ductility or to remove precipitated chromium carbides.

Gas beveling is a rapid means of scarfing the backing steel prior to welding.

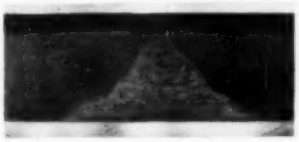
Powder or flux injection methods of oxyacetylene cutting may be used successfully to cut clad steels. However, manufacturer's recommendations should be followed closely. Also, a device which per-

BUTT-WELDING PROCEDURE FOR SINGLE-CLAD STEEL

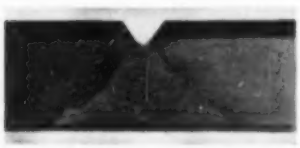
1.. Plates beveled and fitted up for welding steel backing



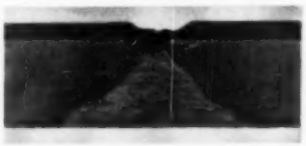
2.. Steel side welded. Bead has penetrated narrow slot in clad



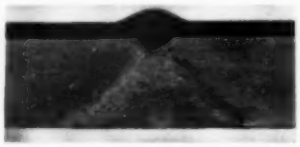
3.. Clad ready for chipping and grinding



4.. Clad prepared for welding



5.. First, or root pass, clad side



6.. Final pass, finished bead

mits a controlled flow of oxygen through the center of a special tubular electrode is used successfully. Fed through the rod, the oxygen is combined with the electric arc at the point where the rod is brought into contact with the material to be cut. Oxidation is hastened by the high temperature generated and the result is very rapid cutting. The above methods permit clad material to be cut easily from either side.

Arc Welding

Cladding materials are used, primarily, for their corrosion-resistant properties. Every precaution must be taken to insure that the fabricated structure will give the required service. Successful welding is dependent upon proper design of joint, and a welding procedure which incorporates the basic principles. Remember that the weld joining clad-steel plates must supply structural strength, as well as maintain an unbroken corrosion-resistant surface.

Steel Clad

Machine plate edges accurately, preferably with a planer. If a planer is not available, beveling may be done by hand-chipping, grinding, or burning. Burned surfaces, however, should be cleaned up by hand grinding afterwards. Manufacturers will provide plates beveled for welding.

Maintain a lip of steel 1/16 in. $+1/32$ in. -0.00 above the cladding. Keep the thickness of this lip uniform. It acts as a barrier to prevent pick-up of the high-alloy cladding material in the mild steel weld.

Alignment Is Important

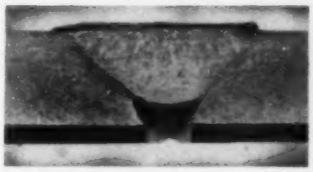
Assemble the vessel and establish the alignment of the clad edges. Tackweld on the steel side with any good grade of carbon-steel electrode. This is one of the most important steps in the production of a sound joint.

Complete the weld on the steel side first, using an electrode that will develop the required characteristics of the backing material. The root bead should be fused to the base of the steel lip, but should not penetrate into the cladding. If the latter occurs, an extremely hard and brittle material is formed.

Time given to close control of the penetration of the root bead on the steel side is more than equalled by the reduced amount of back-chipping or grinding required, and the minimum consumption of high-alloy, high-cost electrodes, when welding the clad side. Proper penetration of this initial weld is very important in producing a sound clad weld. Control is obtained by the use of a larger bevel than used for steel welding, by use of smaller-diameter electrodes, or both.

A penetration of the steel root bead that is too shallow will require an excessive area on the clad side to be removed by chipping and large quantities of alloy weld metal to fill the void.

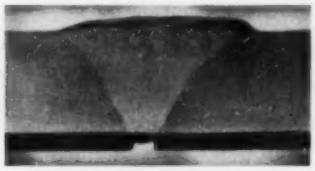
PITFALLS TO AVOID WHEN WELDING STEEL CLAD



(1) **Full bevel** extends thickness of plate, resulting in alloy pickup at root of steel weld (dark etch). Will be difficult to back-chip; may crack

(2) **Oversize electrode** at root pass which has resulted in insufficient penetration and slag inclusions

(3) **Insufficient bevel opening** results in lack of penetration of backing weld metal



(4) **Large root opening** and shear drag have allowed steel root pass to penetrate into cladding

(5) **Excessive alloy** weld metal to compensate for poor penetration and incomplete fusion of steel weld metal

(6) **Poor fit-up** necessitates use of AWS E6012 or E6013 electrode for root bead to bridge wide gap

WELDING STEEL SIDE

CURRENT IN AMPERES

AWS Type		E6010	E6011	E6012		E6020-E6030	
Current		dc	ac	dc	ac	dc	ac
Polarity		Rev.	—	St.	—	St. or Rev.	or —
Electrode Dia.	1/8	80–120		90–130		110–150	
	5/32	120–160		120–180		130–190	
	3/16	140–220		140–220		180–230	
	1/4	200–300		200–300		250–330	
	5/16	250–400		250–400		250–450	

Select electrodes for welding the steel side to agree with the tensile strength of the backing steel. Special backing steels are used for high (molybdenum steels) or low (nickel steels) temperature properties; the electrode composition should be of the same analysis, or one that will produce the required properties. When welding in the flat position, AWS Type E6020, or E6030 electrodes should be used. Run the root bead with proper amperage and a rather high rate of travel to insure penetration. In the vertical or overhead position, use AWS E6010 or E6011 electrodes. Take care to obtain proper penetration by the root bead.

Matching Necessary

Good fit-up is most important to the successful welding of clad steels. Cylindrical vessels, where heads are to be attached, require that the plates be laid out to match the inside diameter of the heads. Spun heads thicken on the straight flange section and the thickening is not predictable. For this reason, it is necessary to check the individual heads and match the shell plates to them. To reduce penetration and danger of pickup of the cladding material, when the fit-up is poor, use AWS Type E6012 or E6013 electrodes in all positions.

Groove Preparation

Chip or grind the clad side of the joint down to clean, sound, weld metal, to remove the unfused area that would act as a stress raiser. This also removes the slag remaining from the backing steel weld that might gasify upon application of the alloy beads, thus producing porosity. When chipping light-gage cladding, a 3/16 in. or ¼ in. round-nose chisel is preferred. On clads over ¾ in. thick, a ⅜-in. to ½-in. round-nose chisel may be used. Chipping has a definite advantage over grinding; the chip will part as long as any unfused section remains.

When grinding the clad side, use a high-speed cutoff wheel. Chip a light groove in order to provide a guide for the grinding wheel, as the high speed of the grinder has a tendency to throw the wheel. Normally, on cladding up to ½ in. thick, a ⅛-in. thick 6-in. dia wheel is used for the initial cut. After the groove is ground to the required depth, a ¼-in. thick, 6-in. dia wheel is often used in order to open up the top section of the groove and provide adequate space in which to manipulate the welding electrode. On heavy cladding, a ¼ in. thick wheel should be used for the first cut, followed by ⅜ in. or ½ in. thick wheel to provide adequate width of groove. Extreme care should be taken when grinding to assure that sound metal has been exposed, as the high-speed grinder tends to smear the metal, thus hiding unfused sections.

WIDTH OF GROOVE — Clad Side

Plate Gage in.	10% Clad in.	20% Clad in.
3/16 to ½	¼	5/16
5/16 to 1 inclusive	⅜	½
1 and up	½	⅝

Welding Tricks

Welding the clad side first in order to prevent pickup of the steel backing material by the welding alloy will result in hard, brittle steel weld metal. The alloy weld metal and the cladding material are picked up by the steel weld metal. When steel is welded on alloy, the cooling rates will result in a hard, brittle material. When alloy is welded on steel, however, the deposited weld metal will be soft and ductile.

Groove depths, as chipped or ground, when proper welding procedures are coupled with good workmanship, should not be more than 1/16 in., or half the cladding thickness, in heavy-gage plates. Copper sulfate-sulfuric acid solution may be used in the chipped or ground groove to reveal that the unfused area has been removed.

Excessive groove depths may be repaired with a steel bead applied from the clad side, taking care, however, to prevent pickup or penetration of the cladding.

Groove widths should be held to approximately the dimensions shown in the chart. Excessive groove depth, a result of lack of penetration in the steel side, may be corrected by increasing the width proportionately to allow electrode manipulation. Groove edges or shoulders should have generous radii to permit proper fusion, to prevent intrapment of slag and to overcome undercuts of the clad surface. For horizontal welds, the bottom edges of the groove can be squared off to give an adequate shelf.

Electrodes for Clad

Weld the clad side of the joint with the electrodes recommended for the various types of cladding, to maintain continuity of corrosion-resistant surface. Selection must also consider the required structural strength in the welded joint, as certain elements are lost in the arc, and the transfer efficiency of oxidizable elements depends on the electrode coating. Both lime and titania base coatings are available for the straight-chromium, and the chromium-nickel steels, but lime coatings have a better recovery rate than titania. Approximate loss of elements during welding with stainless electrodes is illustrated here. These figures for steels of 18-8 type should only be regarded as typical examples, as the rate of transfer may change because of current, speeds, electrode coatings, and other factors:

Element	*Percent in Electrode*	*Percent in Weld Metal*
Chromium	19.00	17-18.00
Nickel	9.00	9.00
Columbium	1.30	0.90- 0.95
Titanium	any am'nt	complete loss
Molybdenum	3.00	3.00
Phosphorus	0.03	0.03
Sulfur	0.03	0.03
Carbon	0.07	0.07

Electrode manufacturers compensate for these losses by increasing the alloy content of the weld wire and the electrode coating, under close chemical control.

Current and Voltage

Alloy electrodes permit only a narrow range of current and voltage. This is critical and manufacturer's recommendations should be followed. If excessive currents are used, the alloy wire will become white hot and will cause the coat-

ing on the electrode to flake off, causing porous welds. Current too low will cause the metal to freeze before complete slagging has taken place or result in insufficient penetration. A short arc should be held by restricting the voltage range, to conserve the oxidizable elements. Direct current is generally used with alloy electrodes; reversed polarity (electrode positive—work negative) provides faster melting of the electrode and less heat input to the steel backing plate. This avoids excessive penetration of the backing material. High-alloy ac electrodes are also available. The current ranges listed may not apply to all brands of high-alloy electrodes produced, but will serve satisfactorily as a guide for most of them.

The higher limits of the range should be used in the flat or horizontal position, while the medium-range limits apply in the vertical and overhead positions.

Straight Chromium Cladding

General practice is to weld these materials with an austenitic electrode, to eliminate the brittle characteristics of straight chromium weld metals. The 25/20 or 25/12 analysis electrodes are normally used, but this does not eliminate the brittle structure in the heat-affected zones of the parent plate. If the weldment is to operate in the carbide precipitation temperature range, or if stress-relieving heat-treatment is required, a stabilized austenitic electrode should be used. As these have a 40 to 60% higher coefficient of thermal expansion than straight chromium material, the location of joints and the nature of restraint should be considered when the weldment is to operate over a wide range of temperatures.

Possibility of galvanic action from the presence of a more noble metal should also be considered. Occasionally, certain corrosive conditions require a weld of straight chromium cladding with straight chromium electrodes. Contamination or dilution of the weld metal by pickup of the backing steel may be minimized by using an electrode slightly richer in chromium than the cladding material, or by applying a number of successive, thin beads of the same analysis as the cladding.

Preheat Benefits

Type 405 material has a small percentage of aluminum added to alleviate the air-hardening tendencies of the basic alloy. Preheating is not required unless heavy gages are to be welded. Types 410 modified and 430 modified, however, are somewhat embrittled by welding, type 410 through air hardening, and type 430 as a result of brittleness associated with grain growth. Both materials may be preheated at the weld zone and held at 300-400 F during welding. The weldment must then be given a stress-relieving treatment immediately following welding and prior to cooling.

Chromium-Nickel Cladding

Dilution in the weld can be controlled by using a higher-alloy electrode than the cladding alloy, as with straight chromium. Usually, the root bead is run with 25/20 or 25/12 electrodes and completed with electrodes of the same composition as the cladding.

Types 301 and 302 are seldom used for severely corrosive conditions, as their carbon content is high and carbide precipitation likely. Applications, such as architectural or decorative equipment, are generally in the lighter-gage materials. Weld these with 25/20 or 25/12 electrode *throughout* their composite thickness.

Weld Type 304 modified and type 308 with a root pass of 25/20 or 25/12, then finish with succeeding layers of 19-9 electrodes.

Types 321 and 347 modified are welded with columbium-bearing electrodes, as titanium is oxidized in the welding arc. Make the root pass with 25/20 CB or 25/12 CB electrode, followed by layers of 19/9 CB. Crack sensitivity, sometimes found with the 25/20 CB or 25/12 CB, may make necessary a root pass of 25/12 or 25/20, followed by a stabilized electrode.

Type 309 is welded throughout with 25/20 electrodes.

Avoid Dilution

Light cladding thicknesses of Type 310 are welded throughout with 25/20 electrodes. As a result of the dilution, it will be necessary to grind off half the thickness of the root bead before succeeding layers are welded.

The root pass of Type 316 modified is welded with 25/20 MO or 25/12 MO electrodes. Succeeding layers are welded with 19/9 MO. For severely corrosive conditions, or when stress-relief treatment will follow, type 316 with 0.03% max. carbon or type 316 columbium-stabilized clad material should be used with stabilized electrodes containing molybdenum.

Nickel and Nickel Base Claddings

Nickel is one of the few pure metals commonly used for cladding as it has much anti-corrosive value. It is impossible to use an electrode that will compensate for iron pickup or dilution.

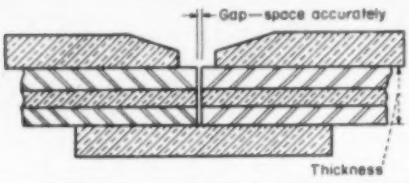
Certain corrosive conditions require that the iron content of the nickel weld must be held to extremely low values. However, a severe limitation on iron content is seldom required as the nickel-iron solid solutions are sufficiently corrosion-resistant.

Use stringer beads on small-diameter electrodes and, where

CURRENT RANGES FOR ALLOY ELECTRODES — Welding Clad Side

Electrode Dia., in.	Chromium Steel and Pure Nickel	Chromium-Nickel Steel and Monel	Inconel and 80 Nickel-20 Chromium
1/8	90–130	70–105	80–100
5/32	125–170	100–140	110–140
3/16	160–210	130–180	140–160
1/4	200–300	240–400	—

BUTT WELDS FOR STAINLESS-CLAD COPPER



Thickness of Stainless-clad copper	Electrode Gap, in.	Electrode Size, in.	Current Amp	Arc In./ Min.	Speed Ft./ Hr	Lb Electrode per Ft of Weld
18 ga	0	5/64	45	15	75	0.020
14 ga	0	3/32	60	12	60	0.038
⅛ in.	0	⅛	90	9	45	0.08
3/16 in.	1/32	5/32	125	7	35	0.15
¼ in.	1/16	3/16	160	8	17½	0.25

Intermediate sizes require slight adjustment in procedures. Chilling effect of copper requires high heats to obtain full penetration of the stainless

iron pickup must be minimized, grind or chip off the top half of the root bead before depositing succeeding layers. The more layers of nickel weld metal, the lower the iron content will be in the top layer. Use of the 80 nickel/20 chromium electrode plus iron on nickel-clad steel produces a composition similar to Inconel.

With Inconel, all weld layers should be deposited with 80 nickel/20 chromium electrodes to compensate for iron pickup or dilution.

Welding Monel

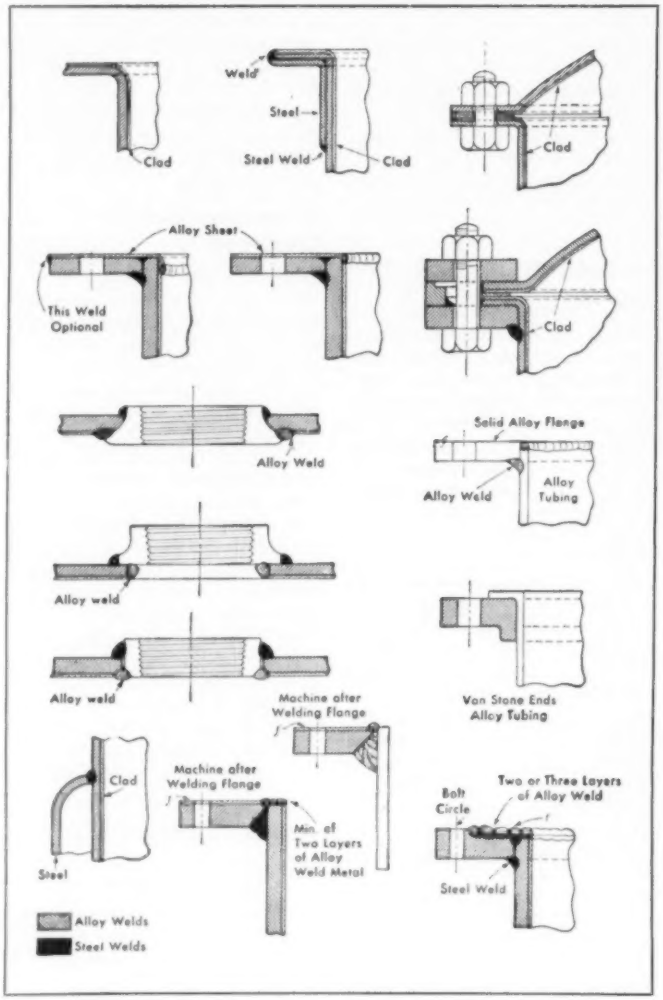
Weld the Monel side of Monel-clad steel with special electrodes developed for that purpose or for the overlaying of Monel on steel. If these special electrodes are not available, an underlayer of nickel must be applied to cover the steel exposed by chipping or grinding, and the balance of the weld made with regular Monel electrodes. A hot-short, or brittle, condition often results from the formation of a copper-iron alloy sometimes encountered when a regular Monel electrode is deposited against steel.

Cupro-Nickel is commonly welded with a 70 nickel/30 copper electrode using multiple layers to overcome iron pickup or dilution. Monel electrodes are used in many cases. The root pass should be made with nickel electrodes as in the case of Monel-clad.

Silver-Clad Steel

With this material it is doubly important that the soft silver surface be protected from accidental damage. Be extremely careful in handling, and protect it further by pasting a layer of heavy paper onto the silver surface. First, however,

PRACTICAL WELDING ARRANGEMENTS



Welded assemblies for various purposes require special positioning for best result

vigorously brush with a dry stiff brush to remove excess graphite before attempting any work with the material.

Any welding method using silver as electrodes is obviated by the high electrical and thermal conductivity of fine silver. As a result of these, the spread and removal of heat from the area being welded is very rapid. Also, while fine silver does not visibly oxidize as do most other metals and alloys, it does absorb gases readily in the molten state, particularly oxygen. The property referred to as "hot shortness of fine silver" is the result of oxygen penetrating the grain boundaries and rendering the silver brittle to subsequent hot or cold work.

Atomic-Hydrogen Arc

To weld fine silver successfully, you must employ a method that is capable of: (1) an intense localized source of heat to counteract the rapid withdrawal of heat from the weld zone, (2) protecting the molten silver from access of oxygen to insure a sound, ductile silver bead.

Atomic-hydrogen arc has proved the most satisfactory method of welding silver clad. It is capable of a higher rate of local heat input than any other usable source and it maintains a reducing atmosphere around the area to be welded. External preheating is not required and it can be successfully used to repair damaged spots, and areas, of silver-clad plate.

Oxyacetylene welding has been extensively used to weld fine silver, but requires more care and skill; it is subject to more difficulties than atomic hydrogen. A neutral flame is required with oxyacetylene to minimize oxygen access to the silver. Often, when welding relatively heavy clad plates, the pressure required to produce a flame intense enough to overcome the silver's conduction of heat away from the weld area, often results in blowing the molten silver away from the joint. However, external preheating, plus welding with a weaving motion to the flame, while at the same time adding silver filler rod, will chill the molten metal and prevent it from blowing away. Oxyhydrogen has been used to a limited extent, but it is difficult and uncomfortable to use. It is cooler than oxyacetylene, hence, a larger flame must be used to melt the silver, resulting in a larger area of the plate or vessel becoming uncomfortably hot. This also causes considerable expansion of the silver and a poorly bonded weld results. It is not recommended for welding large sections.

Carbon Arc

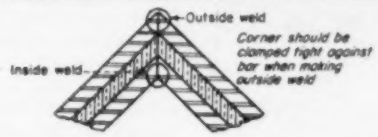
Carbon arc welding has not been successful; is not recommended for any silver welding except where a silver sheet facing must be attached to silver clad. Here it is useful, because with either atomic hydrogen or oxyacetylene, the sheet silver may be easiliy burned as a result of the difference in its mass and heat conductance from that of the silver-clad steel. A carbon-arc weld will have a pleasing exterior, but examination will invariably show it riddled with gas pockets under the surface and the weld not bonded to the steel. Joining clad and sheet silver with the carbon arc forms a heat-conductive path and the weld can then be easily completed with either atomic hydrogen or oxyacetylene. However, when this is done, the weld must be reworked with the atomic-hydrogen arc or oxyacetylene to free the bead from inherent unsoundness caused by the carbon arc.

Steps for Welding

The steel side of silver-clad steel plates and vessels is welded first by the same electric-arc methods used for mild steel. For plates and sheets up to ⅜ in. thick, machine a 45° bevel on the steel side, either down to the silver, or to leave 1/32 in. of steel above the silver. Prepare heavier plates by machining their edges to a U-shape groove having a ¼-in. bottom radius, while leaving a 1/32-in. thickness of steel over the silver, and about a 14° side slope. This will provide a groove wide enough at the bottom for a ⅛-in. coated electrode to be used for the first steel bead without having the arc wander from side to side as in a V-groove. Proper control of welding current and speed will produce a sound weld completely penetrating the 1/32-in. steel protective layer without melting the silver.

Plates and shapes for tacking and welding must be set up so

CORNER WELD FOR STAINLESS-CLAD COPPER

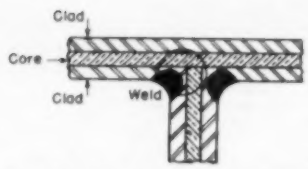


OUTSIDE WELD

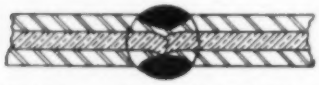
Thickness of Stainless	Electrode Size, in.	Current, Amp	Arc In./Min.	Speed Ft/Hr	Lb Electrode per Ft
18 ga	1/16	30	20	100	0.012
14 ga	5/64	45	19	95	0.016
⅛ in.	3/32	60	15	75	0.028
3/16 in.	⅛	90	13	65	0.057
¼ in.	5/32	125	11	55	0.094

INSIDE WELD

18 ga	5/64	45	9	45	0.034
14 ga	3/32	60	9	45	0.052
⅛ in.	⅛	90	9	45	0.079
3/16 in.	5/32	125	7	35	0.149
¼ in.	3/16	160	5.5	27.5	0.262

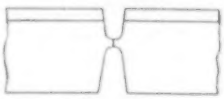


Tee-joint . . Stainless-clad copper. Clad is stripped to core for thickness of plate to be joined. Plate is inserted and only stainless is welded, but to draw plates together. Rigid clamps or jigs should be used to position parts for welding



Metallic arc fillet weld in 0.137-in. stainless clad copper sheet. 18-8 s.s. electrode, ⅛-in. dia. Direct-current, reverse-polarity 100-125 amp, 12-14 ipm manual weld

Inert-gas-shielded arc held in 0.137-in. stainless-clad copper. ⅛-in. dia tungsten electrode, no filler rod, 16.4 liters per min. Argon gas flow. Direct-current, straight-polarity, 8-12 ipm



Double V- or U-joint, with center line of bevel favoring clad side to conserve alloy weld metal

LIGHT GAGE CLAD is welded by:

. . . Beveling plate approximately 70° on the steel side, then welding as with heavier plates

Fit plates tightly together (when poor fusion is not detrimental), and welding steel side first, then clad side

For complete fusion, bevel gap, use copper backing strip, and weld with ⅛-in.-dia alloy electrode

that edges butt together closely, with silver surfaces in the same plane. Any offset in the surfaces of the joined plates will necessitate considerable chipping and filling of the silver weld on the clad side.

Run the first steel bead with a ⅛-in. coated electrode using the current at 150 to 165 amp. This bead, and this setup, will determine the amount of work and silver welding required to complete the silver side. A fairly high welding speed will be necessary to avoid burning through when using the current recommended. Successive steel beads are made using increasing electrode sizes and currents up to 450 amp ac.

Seams

Prepare the seam on the silver side by:

1. For code work, high-vacuum or high-pressure vessels, chipping or grinding the silver along the seam through until sound steel is found. Keep groove as narrow as possible and as shallow as soundness and penetration of the first steel bead will permit.

2. For open vessels, merely clean the silver along the seam by wire brushing.

Silver welding is accomplished by either atomic-hydrogen or oxy-acetylene methods, using fine silver filler rod and no flux. 1/16-in., 3/32-in., or ⅛-in. fine silver rods are most commonly used, and although conditions vary widely, it is well to allow at least 2 ft of ⅛-in. rod per foot of weld.

Welding Technique

For welding 10% silver-clad steel up to 1 in. thick, a 75-amp atomic-hydrogen unit, together with a 75-amp holder using tungsten electrodes from 1/16-in. to 3/32-in. dia, is most satisfactory. Hydrogen pressure for welding should be about 1.5 lb, with the *edge of the fan* produced by the singing arc playing on the work to be welded. Hydrogen is absorbed by molten metals, and the solubility increases with the temperature; therefore the pace at which fusion proceeds should not be forced by burying the fan in the molten pool. Apply silver from the filler rod by dipping the end of the rod into the molten pool instead of allowing drops to fall into the pool. This has a tendency to chill the molten pool and prevent undue temperature rise of the fused metal.

Too-rapid advance or non-uniform advance of the flame along the joint will result in solidification of the silver before the gas can escape, causing blow holes in the silver weld. Uniform flame advance permits uniform cooling rate and allows time for the gas to escape.

Silver welds are usually finished by peening while hot, to harden the surfaces and weld any minor gas cavities in the weld bead.

Stainless-Clad Copper

Materials of this type are used, not alone for corrosion resistance, but also for their high heat-transmission qualities. The high coefficient of expansion of stainless and of copper makes it desirable to clamp long seams in light-gage sheets securely against backings, to prevent or control distortion. The copper interlayer dissipates the heat so rapidly that welds are chilled quickly. However, thicknesses of more than ⅛ in. have greater mass and can be held quite well in any rigid form.

Fit-up Important

As with all other clad materials, it is objectionable to permit any appreciable admixture of copper into the stainless weld. It is desirable to have close physical contact of copper to copper for heat transmission, and all welding procedures are designed to produce such contact by contraction of the welded joint upon cooling. Edges should be cut or ground in such a manner that copper is not dragged across the stainless. Copper drag caused by shearing should be removed before butt-welding. Where one side only need be ground flush in finishing, the material should be so sheared that the feathered edge is finished, so greater strength will thus be developed by the heavier bead on the depressed, or struck, side.

Accurate preparation and fit-up is as important for this clad as

for all others. In metallic arc welding of butt joints with copper-to-copper contact, only the stainless components are joined, but this joint retains a large percentage of the strength of the sheet. The high heat conductivity of the copper is carried through the joint by proper welding procedures.

Stainless-clad copper can be welded by metallic-arc, inert-gas-shielded-arc, submerged-arc, automatic or semi-automatic, carbon arc, resistance, spot, or seam welding.

All of these welds are stainless only, holding the copper core in physical contact.

Weld Strength

Electrodes should match the parent metal. Maximum weld strength is only obtained by following the correct welding procedures to produce as near 100% of stainless fusion as permissible, without admixture of copper.

In a group of weld specimens, four samples were machined flush with the plates for equal cross-sectional area of the plate and the weld. These specimens all broke in the welds. On examination of the cross-sectional area, the welds showed approximately 85-90% of complete fusion in the stainless steel. The welds of two other samples were not machined flush with the plates. These specimens broke about 1¼ in. from the welds, indicating that the full weld has more strength than the parent metal, a result of the excess metal buildup at the joint.

To Improve Strength

Where the welded joint is flush with the plate, it has approximately 70% strength of the parent metal. To improve tensile results, it is necessary either to slow down the travel speed or increase the amperage to get nearly 100% penetration of the stainless steel. In "as is" condition, the weld has much greater strength than the parent metal. If the weld has been machined on one side only, the strength might be expected to be approximately that of the parent metal.

When butt welding by the inert-gas shielded-arc process, the best results are obtained by using dc, straight-polarity, 18.4 liters of argon gas per minute, and ⅛-in. dia tungsten electrodes. A copper clamping jig will hold the plates in alignment. Plates should be butted together allowing no space or gaps before welding. Hand welding is recommended and no filler rod need be used.

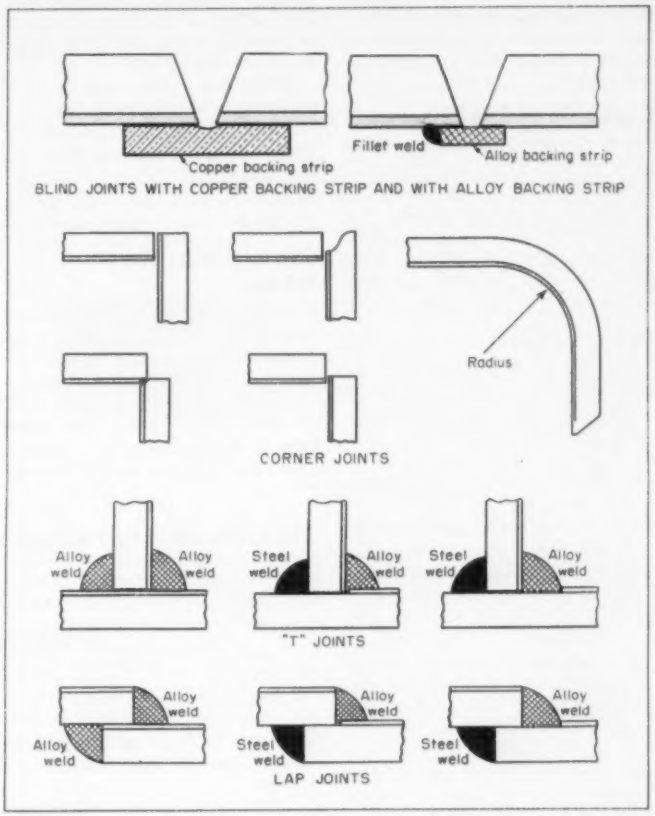
Stainless-clad copper can be brazed or soldered with material suitable for joining the stainless-steel components.

Aluminum Clad

Aluminum-clad material usually consist of a high-strength aluminum-alloy core cladded with pure aluminum as protection against atmospheric or chemical corrosion. Fusion welding of aluminum clads is not desirable, as it impairs their corrosion resistance. Instead, they are spot, seam, flash, or pressure welded, or joined by mechanical means. If they are welded, maximum strength is obtainable only when the part is welded before heat treatment. Fusion welding after heat treatment always produces an indeterminate amount of annealing. However, if resistance welding is employed, clad alloys may be welded after heat treatment as this process can be controlled to reduce the annealing tendency.

Proper equipment, surface prep-

POSITIONING FOR WELDING SINGLE-CLAD STEELS



Welded joints must provide strength plus corrosion resistance, therefore, must have minimum dilution. A radius at corners is preferable to a welded angle

aration, and machine settings are necessary for satisfactory joints. Before proceeding with fabrication, contact the manufacturers of available equipment for technical know-how.

Light-Gage Clads

Three methods commonly used to weld light-gage clad materials are shown in an accompanying sketch. It is recommended that 20% clads be specified for 3/16-in. materials, down, to provide sufficient cladding to give adequate corrosion-resistant welds.

BLIND JOINTS . . . In many structures, joints are found to necessitate welding the clad material throughout its composite thickness from one side. This may be done by using a copper backing strip and either, when the clad surface is on the blind side, welding the entire cross-section of the joint with alloy electrodes or, when the steel section is on the blind side, using steel welding electrodes up to 1/16 to ⅛ in. of the clad line, then completing the joint with an alloy electrode. Also, when the clad material is on the blind side, the backing strip of the same analysis as the cladding may be attached to one of the plates by a fillet weld and alloy weld metal deposited on this strip. In this case, alloy weld metal must be used throughout the joints. When the clad surface is exposed, a steel backing strip suffices and steel electrodes may be deposited up to 1/16 to ⅛ in. of the cladding, followed by alloy electrodes.

CORNER JOINTS . . . Various types of corner joints commonly encountered in clad-steel fabrication are shown. Whenever facilities and designs permit, corner joints should be eliminated and a curved section used.

Welding Double-Clad Steels

The most commonly used methods is the standard "V" or "U" groove preparation as for welding single-clad material. Weld the steel side with the appropriate steel electrodes up to aproximately 1/16 to ⅛ in. of the clad line, and follow by welding with corrosion-resistant material. The unwelded clad surface is then back-chipped and welded in the same manner as the single-clad plate.

Heavy-gage plates can be prepared with a double "V" or "U". The steel section is welded within 1/16 to ⅛ in. of the clad line, and the balance of the joint is then completed with the appropriate corrosion-resistant electrodes.

Cover Strips for Clad Welds

As an added protection against some corrosive materials, strips of corrosion-resistant metal are occasionally applied over welded joints on the clad side. The strip material should be of the same type as the cladding. To permit fitting and welding, minimum strip thickness should be 0.050 in., and never less than the thickness of cladding.

Strips may be arc, or inert-gas-shielded-arc, welded. Procedure for the former should provide adequate but minimum penetration of weld metal into the exposed steel or clad material and should compensate for any dilution. The latter technique may be used on all clad materials except nickel, but care must be taken to provide minimum, but adequate penetration. The weld is usually made without addition of filler metal. High purity (99.9%) helium must be used on Monel-clads.

Overlays of alloys on ferrous materials usually cover small areas, such as flanges and nozzle bases. Welding conditions must provide adequate but minimum penetration

CHEMICAL ANALYSIS RANGE OF ALLOY CLADDING MATERIALS

Popular Name	ASTM Type	AISI Type Number	Carbon, Max., %	Manganese, Max., %
	A—CHROMIUM STEEL CLADDING			
12 Chrome	A-263 Grade O	405[a]	0.08	1.00
12 Chrome	Grade A	410 modified	0.12[b,c]	0.60
15 Chrome	Grade B		0.12[b]	1.00
16 Chrome	Grade D	430 modified	0.12[b]	1.00
	B—CHROMIUM-NICKEL STEEL CLADDING			
17-7	A-264 Grade 1	301	0.08 to 0.20	2.00
18-8	Grade 2	302	0.08 to 0.20	2.00
18-8	Grade 3	304 modified	0.08 max.[b,g]	2.50
19-9	Grade 4	308	0.08 max.	2.00
18-8 Ti	Grade 5[d]	321 modified	0.08 max.[b]	2.50
18-8 Cb	Grade 6[e]	347 modified	0.08 max.[b]	2.50
25-12	Grade 8	309	0.20 max.	2.00
25-20	Grade 10	310	0.25 max.	2.00
18-8 Mo	Grade 11[f]	316 modified	0.08 max.[b,h]	2.50

Popular Name	ASTM Type	Carbon, Max., %	Manganese, Max., %	Sulfur, Max., %
	C—NICKEL AND NICKEL-BASE ALLOY CLADDING			
"L" Nickel[g]		0.02 max.	0.35	0.01
Nickel	A-265 Nickel	0.20	0.35	0.02
Monel	Nickel-copper alloy	0.30	2.00	0.02
Inconel	Nickel-chromium-iron alloy	0.15	1.00	0.02
Super Nickel[i]	Copper-nickel alloy		1.00	

[a] Aluminum 0.10 to 0.30%.
[b] The carbon analysis shall be reported to the nearest hundredth of one percent.
[c] Available with 0.06% max. carbon.
[d] Grade 5 shall have a titanium content of not less than five times the carbon content and not more than 0.60%.
[e] Grade 6 shall have a columbium content of not less than ten times the carbon content and not more than 1.0%.
[f] Grade 11 shall have a minimum molybdenum content of 2.0%.
[g] Available with 0.03% max. carbon.
[h] Available with columbium (not referred to in ASME specifications).
[i] Includes a small amount of cobalt.
[k] Not referred to in ASTM specifications but in analysis range of specifications.
[l] Not referred to in ASTM specification.

of the alloy weld metal in the steel. The first layer of alloy should be applied with ⅛-in.-dia electrode at normal amperage. Dilution is controlled by directing the arc against the back of the weld puddle. An interlayer of nickel weld metal is recommended for applications where Monel overlay must be free of cracks. Second and succeeding layers may be applied, using ⅛-in.- or 5/32-in.-dia electrodes. Submerged-arc welding can penetrate deeply and fuse a large portion of base metal to mix it with welding electrodes. Care must be taken in selection of proper welding conditions to insure successful fabrication by this process. Backing steel should be fully chilled to produce satisfactory welding with the high heat input.

Submerged Arc Welds

Prepare the plate on the steel side in the conventional manner, with the exception that a steel lip of 3/32 in. minimum be left above the cladding surface as double protection against penetration to the cladding. Manually, run one or two beads of steel weld to provide a backing for the submerged-arc weld.

Alternately, plate may be prepared in the conventional manner for automatic welding and the cladding stripped back no less than ¼ in. on each side Provide a heavy lip of steel for backing the automatic weld.

To weld the clad side, chip, grind, or machine the groove down to clean, sound, steel weld metal. Hold groove width and depth to a minimum to prevent excessive dilution. If it is impossible to use an alloy welding wire richer in alloy than the clad, deposit two or more beads. Lightly chip or grind the bead after each pass to assist in reducing the iron content of the finished weld.

Weld Defects

Defects of little importance in ordinary mild-steel fabrication may be of major concern in clad or solid corrosion-resistant materials. Incorrect joint preparation and fit-up result in many of the common defects. Departure from correct procedures will cause welds of poor mechanical and chemical properties.

All undercut sections should be covered with weld metal, as undercutting of the clad surface will reduce fatigue strength and may reduce the thickness or eliminate the protection of the cladding. Incomplete penetrations mean lack of fusion. They initiate cracks at the unfused area and may, coupled with undercuts, offer channels for corrosive materials. Porous clusters in the welds may result from a new electrode, excessive current, instability of the arc, insufficient slag removal, damp electrodes, improper groove preparation, improper electrode manipulation, and poor electrode coating.

To eliminate trouble sometimes caused by new electrodes, start the bead on top of the preceding bead. Burn off approximately 1 in. of electrode before starting the actual weld. Excess metal on top of the previous bead can be chipped or ground off in cleaning. Also, dead shorting the electrode on a copper bar for a brief time prior to welding has proved helpful. When clustered or stringer porosity is found, try baking the electrode at a temperature recommended by the manufacturer.

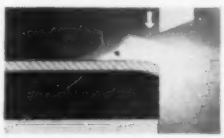
Heat Treating

Generally, clad materials require very little more effort to heat treat than a solid plate of the cladding material. This additional effort is largely closer controls of time, temperature, and atmosphere. Conventional equipment is used; muffle-type furnaces are desirable. Do not expose the material to a direct flame if gas or oil is the fuel.

ANNEALING STAINLESS CLAD COPPER

Max. Furnace Temp. deg. F	Time min.	Thickness in.
1750	10	0.078
1750	8	0.062
1750	7	0.050
1750	6	0.025

Annealing of stainless-clad copper, when stress relief is needed, should follow this schedule. Induction annealing is not recommended



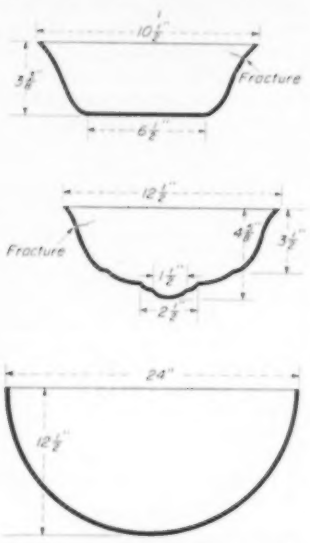
Shear Droop is result of blade's crushing action

MAXIMUM HOT WORKING AND ANNEALING TEMPERATURES
(All Temperatures °F)

Popular Name	ASTM Spec.	ASTM Grade	AISI[1] Types	Max. Hot Working Temp[2]	Annealing Temp. Range	Annealing Cooling Rate
12% Cr	263	0	405	2100[3]	1400–1500	4 or 5
12% Cr	263	A	410	2000[3]	1450–1550	4
15% Cr	263	B	—	2000[3]	1450–1550	4
16% Cr	263	D	430	2000[3]	1450–1550	4
17–7 Cr-Ni	264	1	301	2100	2000–2150	5
18–8 Cr-Ni	264	2	302	2100	1850–2050	5
18–8 Cr-Ni	264	3	304	2100	1800–2000	5
19–9 Cr-Ni	264	4	308	2100	1800–2000	5
19–9 Cr-Ni-Ti	264	5	321	2100	1800–2000	5, 6
19–9 Cr-Ni-Cb	264	6	347	2100	1800–2000	5, 6
25–12 Cr-Ni	264	8	309	2100	2050–2150	5
25–20 Cr-Ni	264	10	310	2100	2050–2150	5
18–12 Cr-Ni-Mo	264	11	316	2100	1900–2150	5
Nickel	265	Nickel[7]		2300	1500–1600	5
Monel	265	Ni-Cu		2150	1600–1700	5
Inconel	265	Ni-Cr		2300	1750–1850	5

[1] See Chemical Analysis Table
[2] Do not heat above maximum temperature of hot working range.
[3] Work to below 1500 F for maximum grain refinement.
[4] Furnace cool at 50° per hour to 1100°, then air cool.
[5] Air quench.
[6] Can be annealed at 1500-1650 F for 2 hours per inch thickness.
[7] Special low-carbon "L" nickel should be used if extensive hot work or annealing is required.

Spinning Copper-Core Clad



Experimentally spun shapes using Types 302 and 347 stainless. Lower bowl received two anneals, others none

Stainless-clad steels require a neutral or oxidizing atmosphere, but nickel-clad, Inconel-clad and Monel-clad steels—in contrast with stainless-clad—should be heated in a reducing atmosphere. Fuels having a sulphur content in excess of 0.5% may destroy ductility of the cladding through embrittlement. Ductility may also be lost by heat-treating clads without thoroughly removing marking paint and protective oils. Wherever possible, the plates should be heated with the clad side up and supported on clean steel rails or on clean firebrick.

Differences in the coefficient of expansion of the backing metals and the cladding seldom give trouble when heating. Usually, prolonged soaking during heating is poor practice; it encourages embrittlement or oxidation, also excessive grain growth, and with austenitic stainless clad, carbide precipitation. Rigid sections, varying thicknesses, or heavy-gage materials with high cladding percentage, should be preheated to help prevent thermal shock.

Holding time at the required temperature should be limited to that sufficient to heat thoroughly all material. Additional time may produce grain growth.

Stainless-clad copper should be annealed according to the chart. Induction annealing is not recommended as the copper layer conducts the current away and tends to make this operation ineffective.

Straight-chromium stainless-clad steels, except type 405, should be furnace cooled at a rate not exceeding 50 F per hour to 1,000 F, and air cooled to produce maximum ductility. Type 405 may be air cooled from the annealing temperature, as it has low hardenability. For maximum corrosion-resistance, austenitic chromium-nickel stainless-clad steels should be air quenched to 800 F, in the shortest time possible, from the annealing temperature. Nickel-clad, Inconel-clad, and monel-clad steels may be air cooled from the annealing temperature.

Clad steels, for hot working, should not be heated above the temperatures shown. Careful handling of the hot metal is required to prevent damage to the clad surface. Work the material exactly as the solid plate. Dies should be dressed to remove burrs which might gouge the clad surface. With straight chromium cladding, the work should be carried down to below 1,500 F in the interest of maximum grain refinement.

For hot pressing, dies are lubricated with a castor-oil base-mold oil. Hot working should be followed by suitable heat treatment to insure that the material is in the proper condition for service.

NON-DESTRUCTIVE TESTS

FOR FREE IRON:

PASTE:

Distilled water	1 lite.
Agar agar	10 grams
Sodium chloride	5 grams
Potassium ferricyanide	1 gram

Dissolve agar agar in boiling distilled water, filter if necessary. Add salts after solution has cooled below 150°F.

SOLUTION:

Distilled water	94% by wt
Potassium ferricyanide	3% by wt
Hydrochloric acid	3% by wt

Paint paste or solution over clad surface. Wherever free iron is present, or exposed, blue spots will appear.

TO TELL CLADDING FROM STEEL

Copper sulphate	10% by wt
Sulfuric acid	3% by wt
Distilled water	87% by wt

Copper will plate out on steel, sharply defining the clad surface boundary when solution is applied to edge of plate.

Machining

Clad materials are not difficult to machine. Backing plates or core material will machine with speeds used for the solid material of the same analysis. Do not allow the tool to ride the clad surface of chrome-nickel cladding, as it will workharden rapidly. Cutting speeds should be a little slower than the speeds used for solid material, but feed should be firm. Clamping should be such that tool forces tend to hold the composite together, rather than separate clad from backing.

Shearing and Punching

Shearing and punching should be done with the clad side up to throw the burrs on the backing side. Shear droop should be considered if the sheared clad plates are to be welded. This is the break in flatness that occurs on the sheared edge as a result of the shearing pressure during cutting. Shear droop can be disregarded where the plate edge is subjected to subsequent machining operations, or if the plate is of light gage. Allow an additional ¼-in. dia for shear droop when ordering headers.

Bending and Rolling

Usually, severe bending or other forming requires that clad material be in the annealed condition. Copper-core does not require quite as many anneals as steel backing, but annealing is still necessary. For all material, radii should be as large as possible and compensation for spring-back should be made when bending. Bending and rolling should be performed hot when low-alloy steel backing is used for heavy-gage clad plate. Allowance should be made, in both design and fabrication, for the fact that straight-chromium clad materials

are not as ductile as other clad materials. However, copper-core materials are more ductile than steel-core. Stresses arising from severe cold working should be removed by annealing.

Drawing and Spinning

Clad materials are a composite of two dissimilar metals. That is the principal difference, and it is slight, between performing these operations on clad materials and on the solid sheets.

Drawing—Generally, the same press speeds and die clearances may be used as would be used with a material of the same analysis as the cladding. There is no tendency for the clad to separate from the backing material. Unusually deep draws in one press stroke are obtainable with copper-core material provided a slow press speed is used, as uniformity of deformation may be spread over a large area. The rules that apply to drawing aluminum clad are the same as those for the solid sheet of the *core* material.

For shallow draws, economies can be effected by polishing the flat stock, applying a mar-proof plastic coating before drawing, and finishing the drawn article with a minimum of polishing or buffing.

Spinning—As with other operations, clad materials spin in much the same way as the cladding material in solid form. This operation is used very often for trimming, beading and finish forming after drawing. Care must be taken to prevent the spinning tool from causing marks and gouges in the clad surface.

The number of anneals necessary to spin a complete shape without cracking must be determined from experience. However, clad producers are always willing to lend their know-how to your particular problem. Consult them before proceeding with an operation you question.

Spinning is eased to a certain degree by the ductility of copper-core cladding. However, stainless-steel surfaces show a tendency to workharden considerably, as do the straight-chromium stainless and nickel steels. Also, the conductivity of the copper is so high that it is difficult to retain the work-generated heat in the metal. Stainless clad copper is generally spun at about one-half the speed used on pure copper. A free spinning type 305 stainless-steel-clad copper has been developed which may be spun at about two-thirds the speed used on copper.

Finishing

Many applications require that welded beads be ground flush or that ripples be removed. Rubber or bakelite bonded aluminum oxide wheels of 16 to 36 grit are generally used for the first grind. Wheels should be free cutting and operate at speeds from 5,000 to 6,000 sfpm. Wheel manufacturer's recommendations should be followed regarding grinding speeds.

Wheel edges should be rounded and grinding proceed along the seams, care being taken not to tilt the wheel. A tilted wheel will soon cut through or seriously reduce the thickness of cladding. Wheels should be allowed to ride the work in the interest of efficiency, and should not be held too long in any one place, to avoid overheating the clad surface. Heat tinting will appear at approximately 400 F. A 40-60, or finer, grit wheel may be used where finer finishes are required than those produced with a 36-grit. If it is necessary to match a No. 4 plate finish, the weld should not be ground level with the plate or a depression may appear when buffing.

The diameter of the wheel should be small and the wheel should be used only for alloy work.

Remember, that a raised bead of stainless weld on copper-core clad will bring the strength of the weld up to the strength of the parent metal.

Buffing and Polishing

Buffing and polishing wheels for clad steels are usually 18 to 20 sections of unbleached muslin wheels of 64/68 to 84/92 count. Wheels are sewed for thickness near the center and flexibility near the edges. Abrasive used is

With exceptions given in this Report, clad materials can be worked just as are the single-metal counterparts of the cladding. Further information is, therefore, to be found in these previously published Special Reports:

How to Work Stainless Steel	Feb. 28, '46
How to Work Magnesium Alloys	Nov. 7, '46
How to Clean Metals	Nov. 6, '47
Adhesives for Metalworking	Feb. 12, '48
How to Finish Copper and Copper Alloys	Feb. 26, '48
How to Reduce Costs of Thin Metal Stampings	June 3, '48
How to Work Aluminum and its Alloys	July 1, '48
How to Use Helium-Shielded Arc Welding	Nov. 4, '48
Rapid Tests for Identifying Alloy Steels	Feb. 24, '49
How to Rubber-Form Light Metals	Mar. 10, '49
How to do Buffing and Polishing	Aug. 11, '49

We Appreciate *the valuable assistance in collecting the data for this Report given by the following firms and organizations:*

Air Reduction Sales Co.
Alan Wood Steel Co.
Allegheny-Ludlum Steel Corp.
Aluminum Co. of America
American Cladmetals Co.
American Iron and Steel Inst.
Bridgeport Brass Co.
Cherry-Burrell Corp.
The Coleman Company, Inc.
Copperweld Steel Co.
C. S. Brainin Co.
Handy and Harman
Hercules Food Service Equip., Inc.
Ingersoll Steel Div., Borg-Warner Corp.
The International Nickel Co., Inc.
Jessop Steel Co.
Kitchen Installations, Ltd.
Lalance and Grosjean Mfg. Co.
Liberty Coppersmithing
The Lincoln Electric Co.
The Linde Air Products Co.
Lukens Steel Co.
Lukenweld
Republic Steel Corp.
Reynolds Metals Co.
Rigidized Metals Corp.
Shock Gusmer and Co., Inc.
Superior Steel Corp.
Washington Steel Corp.

SOLUTIONS FOR CLEANING, PICKLING, AND PASSIVATING

SULFURIC ACID is 1.83 sp g, nitric acid is 38° Be, hydrofluoric acid 40%, hydrochloric acid 20° Be, all acids in parts by volume, unless noted.

Solution "A"—For general pickling and cleaning of stainless steel: sulfuric acid 10, rock salt ¼ lb/gal sol, water, to make 100 parts. Use at 160-180 F.

Solution "B"—For additional pickling and cleaning stainless steel: nitric acid 10, water, to make 100. Whitens surface, may react with mild steel to produce poisonous fumes.

Solution "C"—To remove scale softened by "A": Nitric acid 10, hydrofluoric acid 2, water, to make 100. *Handle acids with care.*

Solution "D"—To passivate stainless steel, seldom required, mix: Nitric acid 10-20, water, to make 100. Use at 120-140 F for 15 min.

Solution "E"—Second choice to passivate stainless steel: Nitric acid 1, sodium or potassium dichromate 1, water 200. Use at 125-150 F for 15-30 min.

Solution "F"—Paste for pickling nickel and Monel: Lampblack 1 lb, Fuller's earth 10 lb, hydrochloric acid 3 gal, nitric acid ½ pt, cupric chloride ½ lb. Use at 70 to 100 F, 20-60 min for Monel, and 2-4 hr or longer for nickel. Apply with whitewash brush.

Solution "G" — (Step 1) Paste pickle for Inconel: Lampblack 1 lb, Fuller's earth 10 lb, cupric chloride 2 lb, hydrochloric acid 3 gal. Use at 70-100 F for 1-3 hr. Apply with whitewash brush.

Solution "H"—(Step 2) Paste pickle for Inconel: Lampblack 1 lb, Fuller's earth 10 lb, nitric acid 2¾ gal, hydrochloric acid ¼ gal. Use at 70-100 F for 15-60 min. Apply with whitewash brush.

Solution "I"—Paste to remove imbedded iron from nickel, Monel, and Inconel: Lampblack 1 lb, Fuller's earth 10 lb, hydrochloric acid 1½ gal, water, 1½ gal. Mix to a creamy paste in glass or ceramic jar. Use at room temp for at least 1 hr. Apply with brush. Follow with hot-water rinse.

Solution "J"—Liquid to remove imbedded iron from nickel, Monel, and Inconel: Hydrochloric acid ¼ pt, ferric chloride 1½ oz, water 1 gal. Use cold, for not more than 1 hr. Rinse as with Solution "I."

either aluminum oxide or silicon carbide. It is customary to reduce grit size in steps of 40. The grit is glued to the wheel, and cardboard or used wheels are inserted between the sections to increase softness and to provide ventilation. Change linear direction of wheels 180° at each change in grit size, to minimize wheel marks in the plate surface.

Sandblasting

Other than protecting the clad surface from local erosion by prolonged blasting, no special technique is necessary to sandblast clad plate. Where scales are tenacious, care must be taken to protect the cladding from severe local erosion caused by blasting on the unscaled section. Pickling or passivation should follow sandblasting to insure that all scale and embedded iron are removed.

Pickling, Cleaning and Passivation

Remove all oil, grease, and dirt by scrubbing with soap, alkali cleaners, or suitable solvents to enable the acid solutions to get at the clad surface.

Immersion of clad materials in acid solutions invites excessive attack of the less resistant backing steels. Instead, swab or scrub the clad surface with acid solution after a short immersion. Acid solution incorporated with fuller's earth and lampblack is an excellent paste pickle for use on the clad surface. Also, the steel surface of the plate may be covered with wax or an acid-proof plastic coating.

Pickling Stainless-Clad Steels

The general-purpose solution for removing scale from stainless clad materials is Solution "A". When exhausted, this solution will cause pitting. Occasionally, this treatment is followed by Solution "B" which will whiten the surface, or by Solution "C" which will materially assist in removing scales softened by Solution "A".

Cleaning

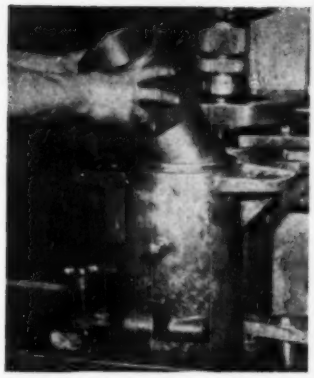
Final cleaning with an acid wash should follow fabrication, sandblasting, or exposure to dirt of any kind. Any of the previously described solutions may be used, but Solution "B" is recommended for this purpose. The vessel should be rinsed with warm water after acid cleaning. Follow rinsing with a neutralization which consists of swabbing the vessel thoroughly with 2% solution (by volume) of ammonia, followed by an additional water rinse.

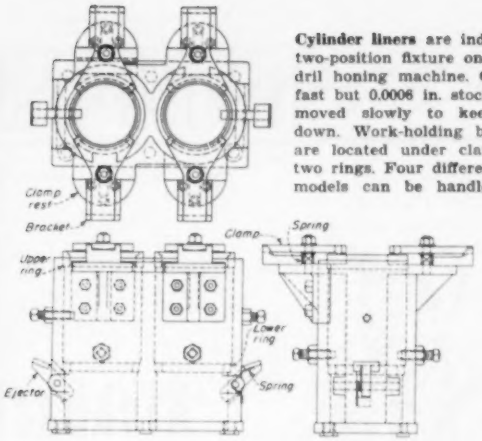
If passivation is required, either Solution "D" or "E", may be used. After passivation, apply a saturated solution of sodium or potassium dichromate to the surface. Allow this to dry then thoroughly rinse, or scrub, off.

Nickel and Monel may be pickled with paste produced as outlined under Solution "F". Pastes fume badly and must be applied in a well-ventilated location. If this location cannot be provided, dilute the acids with ¼ to 1/3 their volume of water. The latter, however, will somewhat increase the time required for descaling.

Inconel requires two treatments: First, Solution "G", which is removed by washing, then Solution "H". After this, the surface is thoroughly washed, and scrubbed with pumice and water.

Solution "I" or "J" will remove imbedded iron from the surface of nickel, Inconel, and Monel Clad. Solution "J" is most suitable for interiors of small vessels.





Cylinder liners are indexed in two-position fixture on Barnsdril honing machine. Cycle is fast but 0.0006 in. stock is removed slowly to keep heat down. Work-holding bushings are located under clamps by two rings. Four different liner models can be handled

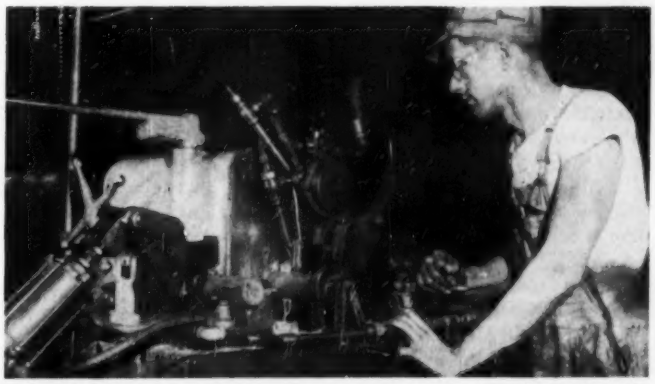
DOUBLE FIXTURES CUT DOWNTIME

BY HERMAN J. SCHAEFER,
Methods Supt., THE OLIVER CORP.

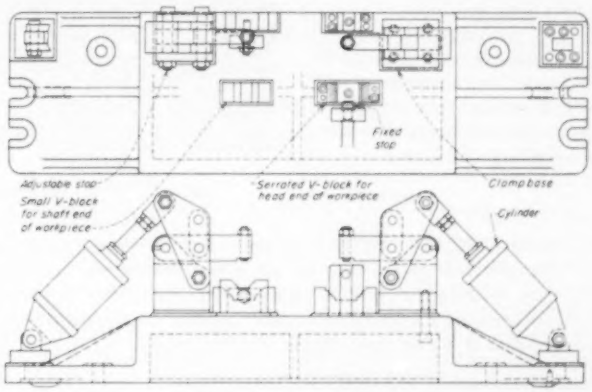
SINGLE-SPINDLE machines, once they are operating at their top cutting efficiency, can only be made more productive by reducing loading and unloading time. Downtime at Oliver Corp's Charles-City plant is cut on two operations by setups that allow clamping and unclamping workpieces while the machines are working at full speed on other parts.

Close-grain cast-iron cylinder liners for gasoline tractor engines are honed on a single-spindle machine equipped with a rotating table. This swings 180° to position a new liner under the hone, and exposes half of a double clamping fixture so the operator can remove a finished liner and reload a new one. Total cycle time for one part is under one minute.

Forged-steel pulley shafts for the same tractor models are clamped in an air-powered fixture that holds two parts. One shaft is faced off at the flange end in the left-hand half of the fixture, and another, already milled at the flange end, is faced off on the shaft end. This allows part setup at alternate locations while the cutter is working. V-block fixtures for two different sizes can be mounted.



Pulley shafts are clamped in V-block fixtures by 3-in.-bore, 4-in.-stroke Hannifin cylinders controlled by four-way valve. K&T miller carries 4-in. face cutter, located 0.125 in. from fixture face in setup. Toggle clamps have cushioned heads to soften action on forged shafts



ROUND TABLE

Kickbacks

"What's come over your gang, Ed?" Al queried as he strolled up to Ed's desk. "I never saw such activity—especially in this department."

"So even you noticed the difference, eh? Looks like the idea is going to work out."

"Difference!" Al frowned. "Why man, just take a gander at Brown over there—he acts like he's been shot in the arm with a dose of A-T-O-M."

Ed let out a chuckle at Al's astonishment. "Brown's just started on that combination die that we thought was going to break the bank. He's been working against time."

"What do you mean, 'working against time'? Does he figure on kicking the bucket soon?"

"T'aint that, Al. The fact is that he's been given that job with a time limit on it—an estimated time, that is."

"Oh!" mused Al, "I see how it is now!"

"You see what?" grinned Ed.

"Psychological pressure, eh?"

"Not on your life, my friend. That boy's made up his mind to show the estimator up—for selfish reasons, of course."

"That won't get him anywhere, Ed."

"Yes it will, Al. Brown's going after the kickback."

"Kickback!" Al jolted back in surprise. "That's all right for optometrists, Ed—but how can toolmakers horn in on that kind of graft?"

"Well, Brown is a pioneer in an experiment," confided Ed quietly. "I told him to do his very best on this die job and I would see that he got reimbursed for every hour under the estimated time."

"You're taking a lot on yourself without talking to the Super, Ed—you might have to dig down deep to make up that money yourself. Is efficiency worth that much to you?"

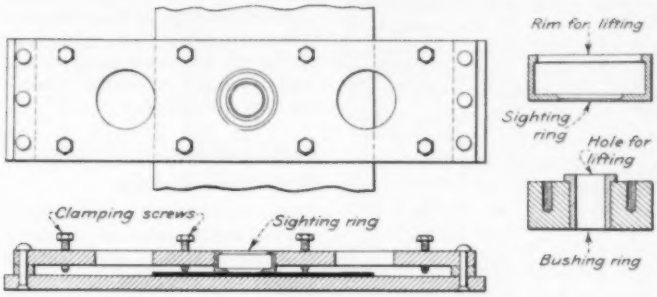
"Simmons is in on the deal, Al, and he told me to go ahead and see how this one tryout worked. If it works we'll figure out a whole toolroom incentive system."

"You'd better look out that you don't start a forest fire with your experimental cigarette butt."

"Let 'er burn," Ed laughed confidently, "It'll cut down the cost all around."

***CAN KICKBACK BONUSES** be made practical? Would they work against the plant force by making time estimates too tight? Or would they bankrupt the company by promoting that extra effort that men are always capable of? And would the extra effort be wise—would it take too much caution and precision away from the men? Other readers will be interested in your comments on the subject. Discussions of earlier topics appear on later pages.*

Practical Ideas



Sighting Ring and Good Layout Produce Accurate Drill Jigs

HOLE SPACINGS for many drill jigs must be accurate, but not so close that a jig borer is required. In cases like this, some shops use a jig borer anyhow, and those that do not have such a machine do the best they can with other means. One method for getting holes close to design size and position is the use of a sighting ring.

Some large bridge-span members had to be drilled so they could be interchanged on the site of erection, so drill jigs had to be made quite accurately. First they were marked off in a templet loft. The hole centers were located, and then a 2-in. circle was scribed around each center to within an accuracy of 0.01 in. A fixture was then made of two plates separated by spacers that would allow slipping each jig plate between the plates of the fixture. A number of 4-in. holes were drilled in the upper fixture plate to allow at least one hole to be located over any point on any of the jig plates.

The sighting ring was made to a 4-in. OD and a 2 1/16-in. ID at the bottom internal flange—this flange made to a knife edge. A matching drill-bushing ring to take bushings for the holes to be drilled was also made to the 4-in. OD. A jig plate, already laid out, was inserted in the fixture, the sighting ring was dropped into one of the holes, and the circle for a jig hole was located by means of the ring. For this the jig plate had to be shifted until the scribed ring was centered inside the 2 1/16-in. knife-edge circle.

The sighting ring was then replaced by a drill-bushing ring and a bushing so the hole in the jig could be drilled. Results were quite satisfactory. *S. H. Pearson, Glasgow, Scotland.*

Midget Vacuum Cleaner Works Off Air Line

ELECTRICAL SPARKS cannot cause danger around flammable oils when chips, dirt, and small parts are removed with this small vacuum cleaner. The cleaner utilizes only an air line for power—no electrical connections.

An aluminum tube was bent and formed into a rough nozzle, and was then fitted with a small tube that was welded into a hole in the larger tube. The small tube bends back and directs air flow toward the small bag that is tied onto the end of the large tube. A simple clamp coupling holds the rubber air line to the small tube.

The force of air from the small tube creates a drop in pressure at the open end of the nozzle, which sucks light material into the bag—much like a conventional vacuum cleaner. The bag is of looseweave cloth that will pass the air but will trap all but fine dust.

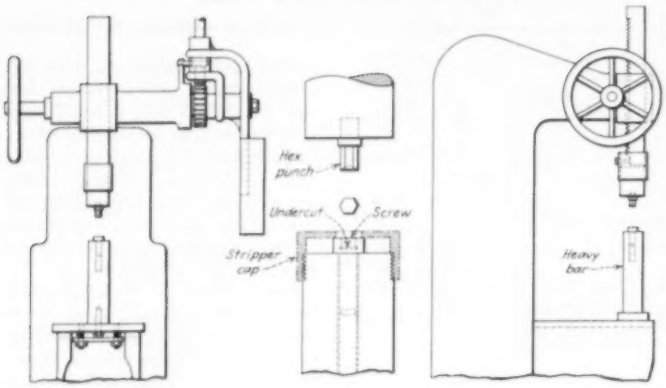
Many sizes of the cleaner are employed for reclaiming small screws and metal parts from assembly benches and also for cleaning spaces that cannot be reached with a broom. *Walter Chiodo and Al Chancellor, Fairfield-Suisun Air Force Base, Calif.*

Shaft Coating Eliminates Bearing Adjustments for Fit

BABBITT BEARINGS are normally poured right on the job, but this normally calls for a freeing-up job—pounding the housing against the shaft—and a lot of peening to make running clearance between the shaft and the babbitt. Because we do a lot of this work, we tried out some experiments, and we seem to have discovered a method of making a bearing without all this fuss.

When the bearing is poured, we coat the shaft with a mixture of shellac and powdered graphite—in almost any proportion. This turned out bearings that we could pour, then forget about. No freeing-up at all was required.

Evidently the shellac forms enough skin to provide working clearance before it breaks down because of the hot metal. The bearing has an internal coating of graphite when it is finished, and this acts as a lubricant. *Frank Biechele, Brooklyn, N. Y.*



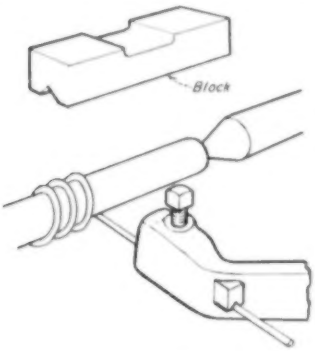
Emergency Broaching Job Forms Hex Sockets in Special Screws

FOR A RUSH shipyard job, we had to make some left-hand, odd-thread screws with socket heads. The screws themselves were easy to make, but the socket heads looked like a long job until we decided to broach them.

The socket holes were first drilled and bored to the distance between flats with a tool that was also used to undercut the walls at full depth.

The broach was set up on the ram of a bench arbor press. Screws were inserted in a heavy bar bolted on its end to the press table. A drilled hole in the bar admitted the screws with a fairly snug fit that prevented side movement.

Smaller screws were socket-broached with the same setup. The only necessary addition was a stripper cap to prevent the smaller screws, which did not fit tightly in the bar, from lifting with the broach. *C. D. Mackinnon, Lanarkshire, Scotland.*



Spring-Winding Block Gripped In Standard Toolholder

SPRING WINDERS are gadgets about which everyone has ideas, but here is one that is probably the simplest to make. It certainly is one of the easiest to operate.

Springs are commonly wound on a mandrel that is centered in a lathe. One end of the spring is gripped between the jaws of a collet, if it will fit, or is bent around a setscrew. The other end of the wire must be controlled, both as for tension and for spacing. A simple, positive way to do this is to run the wire through a toolholder mounted on the slide. That takes care of the spacing—which can be set with change gears and the leadscrew—and a small block of steel takes care of the tension.

The block is clamped in the toolholder like a standard toolbit. A V-groove in its bottom face guides and clamps on the wire, while a slot in the upper face is engaged by the toolbit-locking screw in the holder. Plenty of oil should be applied to the block as the wire runs through. After several trial runs, the correct amount of pressure can easily be gaged. *Edward E. Anderson, San Antonio, Tex.*

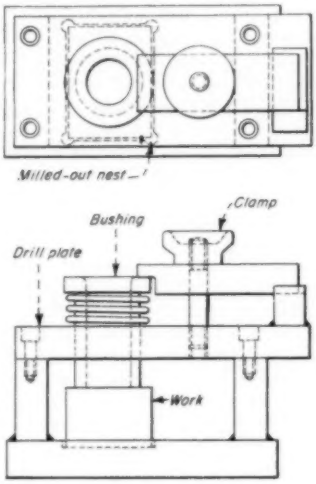
Drill-Jig Clamp Grips Parts Quickly

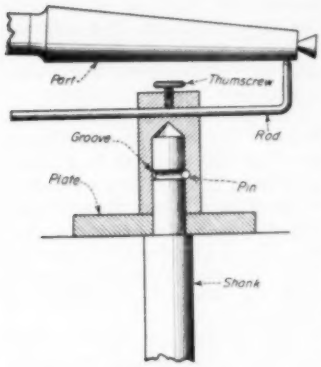
SMALL PARTS that have no projections or are too small to be located in a jig except by their outside contour can be drilled more easily if a clamping drill jig is employed in the setup.

The sample part illustrated is a rectangular block, and has to be drilled right in the center. The jig base was end-milled out to the shape of the part, then supports were welded to it. A drill plate was bolted on the supports, and a clamp rest was welded to it.

Quick action is provided by a spring resting under the lip of the drill bushing. This throws the bushing up away from the work when the handknob is backed off to release the clamp, allowing the part to be lifted up and out of the jig plate.

Loading and unloading the jig is fast, and location is accurate. *H. G. Frommer, Milwaukee, Wis.*





Indicator Rod Checks Taper Setups on Lathe

TAPER DUPLICATION in a lathe is easier when the compound can be set up with some sort of indicator to the correct taper without running the carriage back and forth a number of times.

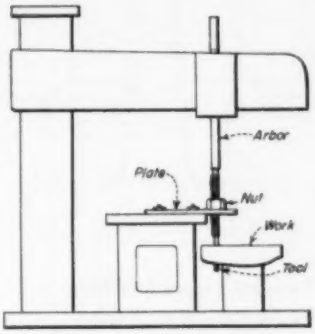
Such an indicator can be made by machining a shank to fit inside an ordinary toolpost and turning the other end so it will support an indicator rod. A drilled plate is driven onto the turned end of the shank so it will indicate squareness of the tool in relation to the compound. A bent indicator rod is clamped by a thumbscrew into a drilled block which fits over the turned end of the shank. A pin driven through a hole in the side of this block engages a half groove that is machined around the turned end of the shank.

If the groove and pin are set up in the correct relationship, the indicator rod can be turned over end-to-end so its positions at each end can be compared to the taper on a sample part. When the compound is set correctly, the sample part can be removed and new work can be set up between centers in the lathe. *H. Moore, Hamilton, Ontario, Canada.*

Radial-Drill Jig Taps Extra-Large Thread

THE HEAVIEST machine tool we have in our shop is a large radial drill, and when we had to cut 2-in. threads in 100 heavy castings, we knew that some sort of jig would have to be made to allow the job to be done on the drill.

I took a 1-in. steel plate, bolted it down to a fairly high table under the drill, and drilled a 2⅛-in. hole. Over the hole I welded a standard 2-in. nut. Then a toolholder was made from a long, 2-in. screw, which was fitted at one end to carry a cutting tool and at the other end to chuck in an arbor in the drill spindle.



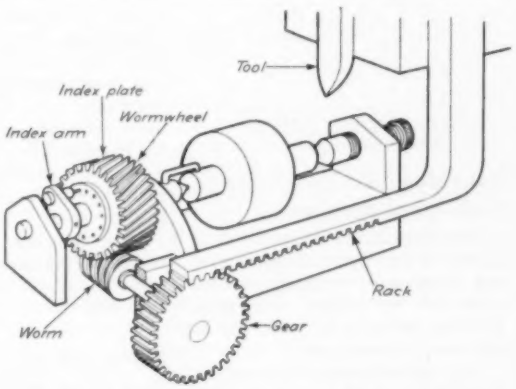
After each casting hole was drilled to the root diameter, the threading tool was mounted. Vertical feed in the drill was disengaged, so the threaded toolholder would be guided by the nut. We were able to finish six castings a day in this manner. *K. N. Nataraajan, Kundara, India.*

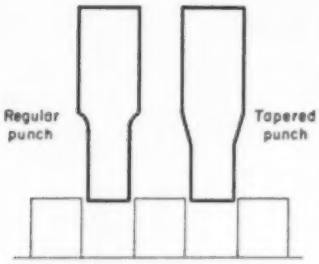
Shaper Rig Positions Blanks for Gear Cutting

HELICAL GEARS can be shaped with the illustrated device, which can be adapted for almost any size or profile. The gear blank is held between an adjustable live center and a driven center that is keyed to an index arm.

The wormwheel, which is fitted to an index plate with the same number of holes as the number of teeth desired, is not keyed to the shank of the driven center, but is rotated by the worm through the index arm. The rack attached to the ram engages a gear that drives the worm shaft in the mechanism.

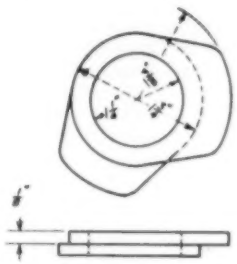
Positive drive of the blank is assured by a rod attached to the work mandrel and to the driving center. Because the diameter of the gearwheel determines the rotation of the work as the ram advances, simple calculations will be necessary to choose the right gear for a given job. When one cut has been taken on the blank, the index arm must be shifted to the next hole—actually the blank is revolved until the plunger on the arm snaps into the next hole—so the next tooth groove will be cut. Successive cuts around the blank will machine the work to the right depth—and, if the tool is ground to the right shape, to the correct profile. Clearance on the back edges of the cutting tool must be allowed for the position of the work as it rotates during a cut. *Gerhard Wenke, Los Angeles, Calif.*





Punches Located in Dies By Centering on Tapers

A QUICK and easy way to locate a punch in a die hole when the press is being set up and when the shank of the punch has a larger diameter than the die hole itself, is to taper the diameter change instead of making a shoulder or a radius. This allows the punch to automatically center itself when it is held upright and it can be located in the upper die in the correct position. *Alfred P. Rheingold, Brooklyn, N. Y.*

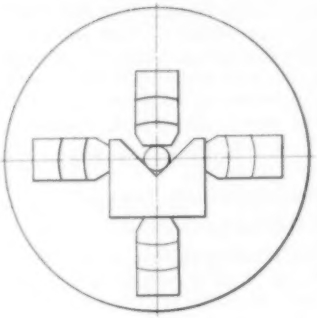


Balancing Disks Smooth Out High-Speed Rotation

A FEW cam-shaped washers can be added to the shaft or spindle of any high-speed rotating mechanism to cut down unbalance. Washers about ⅛ in. thick will do the trick in most cases.

The method was employed for balancing a grinding disk that was 11½ in. in diameter and ½ in. thick, and ran off a ½-hp motor through a flexible shaft. Two bronze disks were added to the grinder spindle. The eccentric weight of each was about 4 to 5½ oz, so the two small washers caused a balancing effect equivalent to 14 lb, which balanced the disk.

Normally two washers can be added to a spindle with their eccentric shapes opposite to each other. After a couple of trial runs with the washers in place, they can be adjusted rotationally until they are closer together—which balances any excess weight on the other side of the spindle. *Paul Grodzinski, London, England.*



V-Block Grips Stock In Four-Jaw Chuck

ROUND STOCK can be clamped easily in a large four-jaw chuck by chucking a V-block, with three of the jaws, and then clamping the fourth jaw directly on the stock.

The three jaws on the block remain stationary, and all chucking and releasing is done by operating the fourth jaw. Of course the V-block must be located correctly so the stock will be centered, and this means that an adjustment must be made each time a new stock size is to be held.

With only one jaw to operate, truing is eliminated except for the initial setup. *Roger Isetts, Kenosha, Wis.*

Rounded-Stock Stops Shed Chips and Dirt

WHEN BAR STOCK is fed into a slitting saw against the end of a regular flat stop, trouble is often encountered with size. The stop may pick up chips from the cutting operation, and because of its shape, and because of oil and grease around the machine, often holds the chips on its end. This naturally makes the bar stock pieces that are cut off shorter than they should be.

The best way to overcome this trouble is to simply make a rounded stop that will shed chips. A bearing ball can be pressed into a bored hole in the regular stop, and the edges of the hole can then be peened slightly to retain the ball. The ball must project enough from the hole to present plenty of surface.

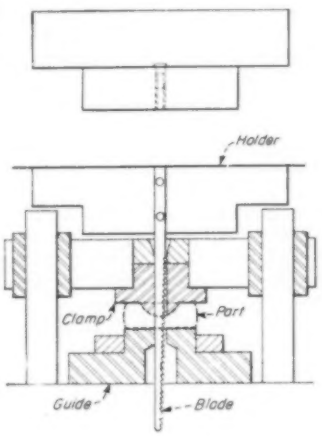
When chips will adhere because the stop cannot be kept clean, the ball can be easily brushed off. *Dan Penway, Carlisle, England.*

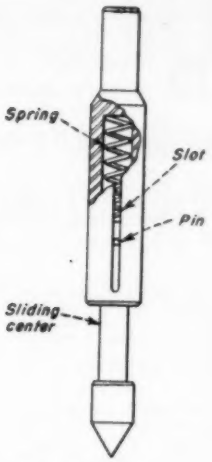
Sawblade-Broach Slots Keyways

FOR SMALL KEYWAYS, a suitable broaching outfit can be made with a high-speed saw blade. The dies are inexpensive, and broach replacment is cheap.

The blade has to be ground to the right thickness for the keyway slot, then ground off on its back edge to a slight taper. This allows the teeth to be left as is, but will line them up in the die so each takes its own load. The load per tooth should be 0.002 to 0.003 in.

The clamp is locked manually to locate the work positively. *James Harrington, Middle Village, N.Y.*





Spring Center Aids Hand-Tapping Job

HAND-TAPPING large or special holes is necessary sometimes. A good way to do this is to start the tap in the hole before the work is removed from the drillpress to a bench. However, this is usually a hard job because the machinist really needs two hands to start the tap, and the tap is best supported by a center in a Jacobs chuck in the drill spindle.

Instead of working the handfeed lever with one hand, the mechanic can make a simple spring center to take care of that part of the job—leaving two hands free for the tap. The shank of the center is turned, bored to fit the sliding center and spring, and slotted. The slots are for a small retaining pin that holds the center assembly together when it is not under compression.

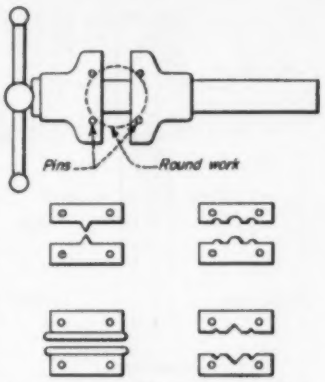
After the spring center is chucked, it is brought down on the tap—which will be turned with a wrench—until the spring is compressed. Then the downfeed is locked, and the mechanic starts the tap with both hands. When retracting the tap, the center is forced back against the spring, which helps keep the tap perfectly in line. Fit of the sliding center inside the shank of the tool should be close to prevent wobble. *Allan B. Nixon, Springfield, Mass.*

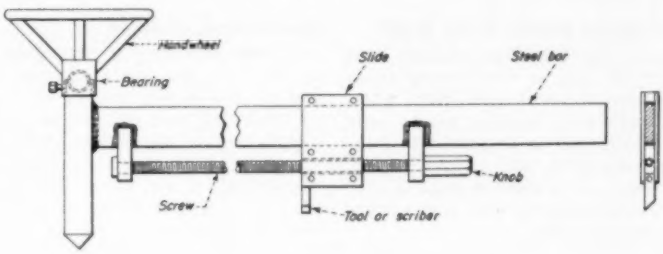
Vise Adapters Widen Clamping Range

MOST SHOPS do not care to invest a lot of money in a machinist's bench vise with swivel jaws, built-in anvils, and fancy attachments, but a machinist can adapt a standard vise for special jobs by using up some spare time.

The first thing to do is to drill two blind holes in the top of each vise jaw for good-size pins. The pins, by themselves, will hold flat round work horizontally. Then sets of special adapters, like those illustrated, can be made to fit over the pins and to clamp odd shapes in the vise.

The adapters can be cut in all sorts of matching shapes for round, V-shaped, and square work. One set can be made with canvas or leather sacks filled with sand to hold knurled or highly finished work. The pins can be removed, when necessary, to clear the vise top. *George F. Burnley, Oakland, Calif.*





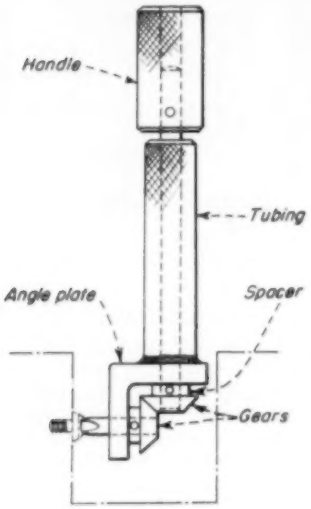
Scribing Tool Marks Off Accurate Circles

FAIR PRECISION can be attained with a circle-cutting tool designed with a leadscrew that controls the radius setting. The device is built up on a sturdy steel bar that is welded to a center.

Pressure can be applied to the center through a handwheel, which has a bearing ball mounted underneath it. This coupling can be locked with a setscrew, which allows turning the whole assembly from the wheel and also holds the parts together when they are stored. Two small straps welded to the bottom of the bar are drilled to form sleeve bearings that carry a leadscrew. This is fitted with a retaining shoulder at one end, and a knob at the other.

A slider that rides on the steel bar is drilled and threaded for the leadscrew, so turning the adjustment knob moves it up and down the bar. Either a scriber or a cutting tool can be mounted on the slider, depending upon what kind of marking is desired. The slider is built up from flat plates, which can be clamped together on the tool or scriber by means of small screws. A central plate is threaded.

Fits are made fairly tight so no play in the bearings or the slider will develop to ruin the accuracy of the tool. If desired, the steel bar can be marked off in radius measurements, or a steel scale can be attached to indicate measurements. *Tyler G. Hicks, Summit, N. Y.*



Right-Angle Screwdriver Is Driven Through Gears

FOR ADJUSTING screws in close quarters where other kinds of screwdrivers cannot work (including flexible-shaft models) a geared driver can be made.

Commercial parts can be utilized in its construction. Two small right-angle bevel gears are supported by a small angle plate that is welded to a piece of tubing. The tubing supports the longer rod of the driver, which is fitted with a knurled handle. Bored spacers, like washers, are inserted on both shafts between the plate and the gears.

The tubing should also be knurled so a good grip can be obtained. *Frank J. Peragine, S. Hempstead, L.I., N.Y.*

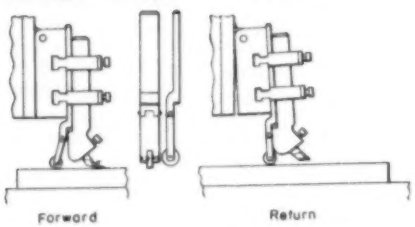
Magnet Braces Sheet Metal

A LARGE horseshoe magnet is a handy item to have around shops that do a lot of sheet-metal work. Small sheet-metal or tubing parts which have to be brazed or soldered can be held by the magnet, either on its sides or ends, so they can be easily worked. *Roger Isetts, Kenosha, Wis.*

Square Stock Chucked

A THREE-JAW CHUCK can grip square stock if a hex nut is employed. If the nut can be driven over the end of the stock (which should be slightly wider diagonally than the diameter of the socket) it will upset enough stock to act as a drive. *Frank Biechele, Brooklyn, N. Y.*

Mechanical Tool Lift Rolls Along Shaper Work



AN AUTOMATIC pneumatic tool lift was recently described in Practical Ideas. Here's a mechanical one that is easy to make and install on a planer or shaper.

The lift is made from mild-steel bars, and is clamped under the toolholder in the clapper box. It must be offset as shown to clear the toolholder. The pin joint forms a knee that allows the roller to trail behind on a forward stroke.

On the reverse stroke, the knee cannot bend forward, so the roller moves close to the tool and lifts the clapper box, thereby clearing the tool from the work. *S. Framurz, Bombay, India.*

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92nd Winner

N. Bonamini

Precision Drilling Jig

Germany to Pass U. K. in Machine Tool Output by 1952-53

Production, Import, Export Situation of 6 Major Tool Categories Studied by OEEC

NEW YORK—Bizone Germany will regain her prewar predominance over United Kingdom by 1952-53 in production of six major categories of machine tools, according to an official study made by OEEC in Paris. Her output during that fiscal year will be $54.9 million, compared with Britain's $51.3 million (in automatic lathes, center lathes, boring and milling machines, drilling machines, gear cutters and planers). These six categories comprise one third of the machine tool market.

$250.6 Million Production

This study, only an "educated guess" at best, forecasts total production in ECA countries, including Britain, of $250.6 million of machine tools (in the six classes listed) in 1952-53 fiscal year, as against $139 million in 1947 and $181.9 million in 1938. Of the 1952-53 total, Bizone Germany (not counting Russian zone) will account for 22%, United Kingdom 20%, Italy 13.4%, France 11%, Switzerland 10.4%, Belgium 8%, Sweden 7%.

OEEC undertook at the end of 1948 to find out the situation in production, import and export of machine tools. A second inquiry was undertaken in the six categories of machines mentioned above. All of these comprise one-third of the machine tool market. Three reference years chosen were 1938, 1947, and 1952-53.

Here is the breakdown in the six categories for those years, showing production in millions of 1948-value dollars:

	1952-53	1947	1938
Center lathes	88.5	48.5	67.2
Automatic lathes	29.4	13.3	22.8
Gear cutters	16.3	7.4	10.6
Grinding machines	45.3	24.0	36.6
Boring & milling	40.5	23.7	24.7
Planers	12.9	6.1	12.8

Imports into participating countries (western Europe and Britain) will be $53 million in 1952-53 in six classes of machines. Some $30.6 million will originate in the participating countries (trading with each other) and $22.4 million in the United States. Here are the details on total imports in the six categories for 1952-53, in millions of dollars:

	(From participating countries)	(From dollar areas)
Austria	2.1	0.9
Belgium	2.3	1.6
Denmark	0.9	—
France	6.3	4.6
Greece	—	2.3
Italy	1.1	4.9
Norway	0.7	0.07
Netherlands	7.5	2.0
United Kingdom	0.5	2.0
Sweden	6.4	2.5
Switzerland	0.6	0.2
Bizone Germany	2.1	0.6

Production for 1952-53

(millions of dollars)

Bizone Germany	**55.0**
Center lathes	20.0
Grinders	13.5
Automatic lathes	9.0
Planers	2.5
Boring & milling	5.0
Gear cutters	4.0
United Kingdom	**52.0**
Center lathes	21.0
Grinders	13.5
Boring & milling	7.0
Automatic lathes	7.0
Italy	**34.0**
Center lathes	14.5
Grinders	6.0
Planers	3.0
Gear cutters	4.5
France	**28.0**
Center lathes	13.0
Grinders	4.5
Boring & milling	4.0
Switzerland	**25.0**
Automatic lathes	7.5
Boring & milling	6.0
Center lathes	4.5
Grinders	3.0
B.L.E.U.	**20.0**
Center lathes	11.0
Boring & milling	5.0
Netherlands	**8.5**
Boring & milling	4.0
Denmark	**5.0**
Boring & milling	3.0
Austria	**3.0**
Center lathes	1.5

Share of Each European Country in Relation to Total Production

(6 categories of machine tools)

	1938	1952-53
Austria	1.0	1.2
Belgium	2.1	8.8
Denmark	0.4	2.2
France	9.0	11.0
Greece	0.1	0.1
Italy	11.0	13.4
Norway	0.3	0.3
Netherlands	—	3.5
United Kingdom	19.0	20.0
Sweden	3.5	7.0
Switzerland	9.0	10.4
Bizone	43.0	22.0
Fr. Zone, Germany	1.6	0.9

All countries in 1947 were producing 76% of 1938 output. By 1952-53 it will be 138%.

Calif. Firm Seeks to Scale Aircraft Parts Down to Automobile Prices

LOS ANGELES — Small aircraft parts manufacturers face stiff competition from Aviation Dealers Corp., headquartered here, which is marketing CAA-approved parts under its own "Adco" brand at from 25 to 50% the list price of name-brand parts.

Officials of the corporation, which is set up to act as a manufacturing distributing cooperative, believe this is the first wedge against what they call "excessive prices for small plane parts." Aviation Dealers Corp.'s aim is to scale plane parts down to automotive prices.

Owns Its Own Dies

Adco owns its own dies and contracts with private manufacturers and machine shops to produce its brand parts.

The company is now testing component parts — including pistons, sparkplugs, and others—for the most popular of small craft engines. In some cases, machine shops are manufacturing the parts, using Adco dies. In others, the same manufacturer which makes the part for the name-brand company, is producing a comparable part under the Adco brand.

Large Volume Plays Part

Drastic price reduction is made possible by a small Adco mark-up, and the absence of high distributor margins. Large volume is another contributing factor.

Among Adco-brand parts now on the market—most of them manufactured by non-aviation companies—are: Tail wheels and assembly sparkplugs, wheel pants, exhaust stacks, brake parts, batteries.

Lockheed Incentive Program Cut Manhours From 790 Down to 400

SAN FRANCISCO—Manhours on a fuselage building job were cut from 790 to fewer than 400 under an incentive program developed at Lockheed Aircraft Corp., H. E. Ryker, company vice president, told business and industrial leaders at an American Management Association meeting in mid-January.

He spoke on "Cost Reduction—Machines, Methods, Men?"

Ryker explained that on this particular operation supervision had tried to cut costs by methods improvement, but there seemed to be little that could be suggested. So, he said, "the boss talked it over with his crew and they set about to see just what they could do."

"Their first objective was for 600 hours. They hit it. They then tried for 500. They made that, too. Currently, the assembly is being built with less than 400 manhours."

Nor was this an isolated instance, he reported. "On the group of Constellations set for assembly in coming months we expect to reduce our manhours 12% from the 1949 level."

"Not methods nor new machines, but teamplay and leadership, with encouragement and recognition of accomplishment, were the answer."

(The company doesn't slight the importance of modern machinery, however—Lockheed has invested an average of $11,225 for each production worker, compared to a national manufacturing average of $7,900.)

Working with the individual in a "grass roots" cost reduction program is particularly important in the airframe industry, he said, where labor makes up 43% of the cost of building a plane, and where the custom nature of the operation makes determining job standards difficult.

So the company carries its story to each worker, talking costs, competition, objectives and plans by word of mouth, by letters, by articles in the company paper and by plainly written financial reports.

To achieve teamplay, Lockheed divides its working force into small groups, called "cost centers," each under the direction of a full-time supervisor. Objectives and accomplishments for each center are set up and measured.

The company currently is breaking objectives down to the individual man, and has found that in centers in the fabrication shops where this has been done, output has increased from 30 to 50%.

Steel Companies, Labor Argue Over Price Hike

WASHINGTON — There was quite a to-do over Sen. O'Mahoney's investigation of the 4% steel price increase, but nothing real is going to come out of it. The same thing happened two years ago when steel prices went up $5 a ton.

The steel companies justified the increases on the ground that costs still are rising, particularly for labor because of the new industry-paid pensions.

But Otis Brubaker, research director for the United Steel Workers of America, CIO, accused the industry of attempting to make a scapegoat of labor for the recent price hike. Actually, he charged, there has been a "net decline in total steel making costs for the industry," asserting that the cost of scrap is down $400 million annually, and savings of more than $80 million have been realized on decreased cost of nonferrous metals and fuel oil.

Nash Tells Where Most Air Drag Is In Tests on Eleven Auto Bodies

NEW YORK—Tests of aerodynamic qualities of 11 bodies used in 1949 cars indicate wide variation in the efficiency of the designs. These bodies represent virtually all standard makes for that year because frequently the same body is used for several makes of car.

Wind-tunnel tests of the actual cars were made at the University of Wichita for Nash Motors. L. H. Nagler of Nash revealed the test results at a meeting of Metropolitan Section of the Society of Automotive Engineers held here Jan. 19. Some results:

Exterior sun visors of the new type with a space between visor and car top added about 9% to air drag. At 60 mph these visors cost 2 to 3 hp, or about 1 mile per gallon.

Shielding the front wheels cut air drag 1 to 2%.

Streamlining the underside with a canvas shroud reduced air drag 6.3%.

Rear-end styling appears to have a major effect on drag. The six highest-drag cars were all of the notchback type, while three of the five lowest drag cars were of the slipstream-back type.

Sharp issue with some of the findings was taken by Phil Pretz of Ford Motor Co., who discussed tests in the Ford wind tunnel and on the road. These tests indicate that frontal area has a greater effect on air drag than rear-end styling.

While agreeing that aerodynamic research was important in car development, Mr. Pretz said that other factors contributing to performance and comfort were often of greater importance and cars should not be built with low drag as the major aim.

Charge Steel Producers Discriminate Against West

SAN FRANCISCO—An anti-trust suit against major eastern steel producers charging discrimination in rates and trade practices against western consumers has been filed in Federal District Court here by Aero Sales Co. and the Texas Tank Corp., both of Houston, Tex.

The companies ask $4,516,500 in triple damages, claiming that the big steel companies give preference to steel buyers in the East and have favored prewar East Coast firms over postwar firms, causing western firms loss of contracts. The case was filed here as the home office of Columbia Steel, a defendant.

***ENROUTE TO AUSTRALIA** is this unique 127-ton roll grinder shipment made by Landis Tool Co., Waynesboro, Pa. The grinder can swing round work up to 5 ft dia and has length of 24 ft between work centers. It required 29 tons of lumber to make the skids and siding for these 10 cases, which compares with approximately 25 tons of lumber for the average 6-room frame house*

Strike Viewed As New Pension Drive

DETROIT—The start of a strike Jan. 25 in Chrysler plants by the CIO United Auto Workers union was being construed here as the kickoff of a new kind of pension drive by organized labor—one in which companies would be pressed to guarantee not only a scale of pension payment, but also a scale of cents-per-hour contributions to the fund.

Up to now most pension programs have left it up to the company to put in whatever was necessary to make the benefits pay out. These sums were left "floating" because of the general expectation that federal old age benefits—a factor in nearly all existing plans—would be enlarged.

The UAW now has switched to the view that if an advance is to be realized, the companies must contribute fixed amounts. Companies are apprehensive that if this viewpoint prevails and they contribute more than is necessary to their respective funds, then the unions will come back at some future time and make demands for the money in one form or another.

The Chrysler strike threw a cloud over the hitherto bright and cheery Detroit industrial landscape. About 89,000 workers were directly involved, all but 10,000 of them in Detroit plants. Briggs Mfg. Co. plants which build a large share of Chrysler bodies, shut down almost concurrently, idling another 20,000 people. Other suppliers were receiving stop shipment orders by telegraph, and were laying off people rapidly. Some expectations were that the total would grow to 150,000.

Steel blanks are hand-fed into press, as in photo at left; then, in the sequence shown above . . .

Tank Part Is Deep Drawn with One Stroke of Press Using Special Dies

CLEVELAND—Converting a 12-gage steel blank of 38¼ in. dia into a 24½ in. long by 14½ in. dia shell in one operation and at the rate of 100 to 144 units per hr is the achievement at Scaife Co.'s plant, Oakmont, Pa.

It is an accomplishment shared in by Scaife, Hydraulic Press Mfg. Co. of Mt. Gilead, Ohio, and Schnell Tool & Die Co., Salem, Ohio. Scaife engineers had the idea for the unique operation, HPM engineered and built the press and Schnell manufactured the dies.

In drawing the blank to its final measurements—which constitute a half of a low pressure L-P gas tank when finally assembled—a 63% reduction is made as compared to the conventional 40%. However, even that deep a draw has been bettered by 8% on experimental runs.

Two Continuous Draws

Such a deep draw, while made with a single set of dies and in one continuous operation—saving the cost of one heat treating operation and investment in a second press plus necessary manpower—actually is made in two continuous draws during which the blank is literally turned inside out, after the first step in the drawing operation.

Secret of the operation is in the hollow punch in the main ram and the solid punch attached to the bolster plate.

In operating, the blank is fed into the draw ring. Normal draw is made. The blank holder then remains stationary for the balance of the stroke. The main ram descending forces the hollow main punch through the draw ring to redraw the first cup 21¼ in. dia by 12 3/16 in. deep. The metal is then clamped between the tapered end of the hollow punch and the die cushion ring. Further descent of the hollow punch forces the first drawn cup over a solid punch attached to the bolster plate, turning the 24½ in. cup inside out in drawing it to a 14½-in. dia by 24½-in. deep shell. A hydraulic knock-out cylinder inside the hollow punch ejects the vessel as the main ram returns.

The press, standing 28 ft 10 in. above the floor, weighs 253,000 lb and installed with HPM's performance guarantee carries a price tag of about $250,000. Dies cost $12,000 to $15,000. Some idea of its size can be had from its 200 ton die cushion, a stroke of 84 in. on the main slide, and 135 in. of daylight between the main slide and bolster plate. Its opening and closing speed is at the rate of 1000 ipm.

The scrap loss—22 to 23%—suffered in making the blanks is quickly recovered in lessened processing costs. However, exacting equipment is needed with special dies in the blanking operation since clean, sharp edges are an absolute necessity on blanks used in this type press.

The reverse redraw hydraulic drawing press, is not entirely new since Buhl Mfg. Co., Detroit and Wheeling Steel Corp. have used the principle for forming light weight metal for the past few years in comparatively small size and thickness. Up to the present, however, the maximum reduction obtained in a single draw was 49%.

France, Paraguay to Exchange $1 Million in Industrial Goods

PARIS (McGraw-Hill World News)—France hopes to expand trade through a reciprocal commercial agreement with Paraguay, signed Dec. 9, involving a total exchange of more than $1 million worth of goods from each country. Among the most important French exports covered by this agreement are the following:

Automobiles, trucks, tractors, spare parts, $85,000; siderurgical products, $90,000; electrical apparatus, $50,000; radioelectrical, telephonic and telegraphic material, $50,000; machines, miscellaneous, $50,000; transmission belts, $25,000; small tools, hardware, $50,000; tires and other rubber goods, $25,000; plastic goods, etc. $25,000.

Tapered Aluminum Sheet Due Soon

WASHINGTON—Production of tapered aluminum sheet for wing surfaces of the new sonic-speed airplanes is close to a reality. Another six months should bring out limited production of the badly-needed material.

The big three in aluminum, Reynolds, Kaiser, and Alcoa all have been working on the problem under development contracts issued by the Air Force about a year ago. To date the problems have outridden progress, but progress is being made.

About the best that has been done so far is a 15 to 20 ft longitudinal taper on a 3-ft width. And, in this experimental work, the tapers have not been uniform. Trouble mainly has been in controlling the motors which operate speed and pressure on the rolls.

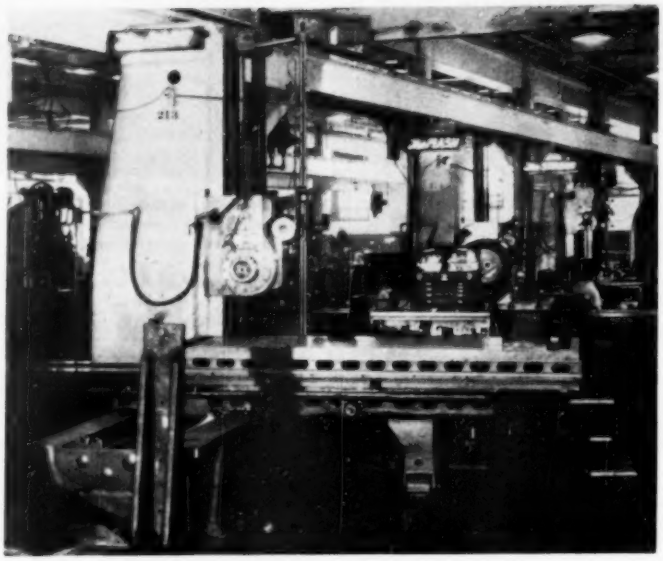
Lately, however, progress has been made on lengthening the taper, and smoothing out the operation. Reynolds, for instance, has on order an electronic motor control system which it believes will eliminate the bumpy sheet and also allow longer and wider tapers. Although the Reynolds experiments have been on small rolls, development of the new servo-mechanisms will allow rolling of the sheet on larger equipment which means widths up to 100 in. or better. Experimentation, and eventual production, is being done at the Lister Hill, Ala. mill.

Kaiser's Permanente Metals Corp. has been conducting research on tapered sheet at its Trentwood, Wash. mill, with some progress, although not too much information is immediately available. Some of the "can'ts" of tapered sheet, this company finds, include rolling sculptured sheet, or variations in tapers, and the rolling of ribs on the underside of the taper.

New Rolling Mill at Alcoa

Alcoa's huge new rolling mill at Davenport, Iowa, will allow that company to roll sheet up to 120 in. wide. Length of taper is still a problem. Here again development of new servo-mechanisms or adaptation of current ones remains a problem.

Methods other than rolling of tapered sheet have been tried by all three producers but they have not worked out. Cross-wise rolling of tapers failed to work. Another idea, cutting an ingot "on the bias," spacing the two wedge-cuts with a divider, then rolling the reassembled ingot, also has not worked out too well. The only realistic method developed so far is a longitudinally rolled taper.



***NEON NAME SIGNS** recognize the shopman's penchant for naming larger units of equipment at Rice Barton Corp., Worcester, Mass. These three G & L horizontal boring machines are named in order, "Dart," "Flash," and "Streak." Two high-speed Cincinnati planers and two big Cincinnati millers carry the names "Arrow," "Bullet," "Comet," and "Rocket." Outboard supports on table runway of first machine prevent sag in machining long work. Photo by Howard Rich, Jr.*

Military and NSRB Fight Over Size of U. S. Merchant Marine

WASHINGTON — Government-aid-to-merchant shipping is at stake in a bitter behind-the-scenes fight among Washington bureaucrats. If the decision is to cut-back Federal help to operators and builders the size of our active fleet will dwindle even more. Shipyards will get fewer orders for repair and new ships; some may even be forced to close down. That would mean more trouble for the metalworking industries.

The big question is whether in another war the U. S. is to be prepared with a strong merchant fleet of its own ships. Or, as some would have it, we'll rely on the ships of our allies.

In one corner are the Joint Chiefs of Staff, seconded by the U. S. Maritime Commission, who figure their minimum D-Day needs at 1,200 active merchantmen, plus another 1,800 in the reserve fleet, callable at a rate of 150 per month. They count on much heavier losses from submarines than we suffered at the outbreak of World War II.

In the other corner is the National Security Resources Board, seconded by the State Department, which figures we won't need anywhere near that many ships. They argue that bigger and better than prewar fleets of other North Atlantic Pact nations will be more than sufficient to carry troops and supplies of another war. To prove it they've got a mobilization plan for the international take-over and control of all N.A.P. ships. The U. S. role would be small.

Actually, the chances are the military will get its way; Maritime Commission Chairman Philip B. Fleming has the President's ear, is for a strong U. S. Merchant fleet. Congress will be the determining factor however. Its policy has long been for a strong federally aided Merchant Marine. Rep. S. O. Bland's (D., Va.) House Merchant Marine and Fisheries Committee has already completed action on a bill up-dating the Merchant Marine Act of 1936 which extends additional benefits to ship builders and operators. Chances are, now, it will be passed this session. And, President Truman, who counts heavily on the labor vote, can't be too obviously for anything that would put a lot of merchant seamen and shipyard workers out of work.

How to Compute Tool Cost Return

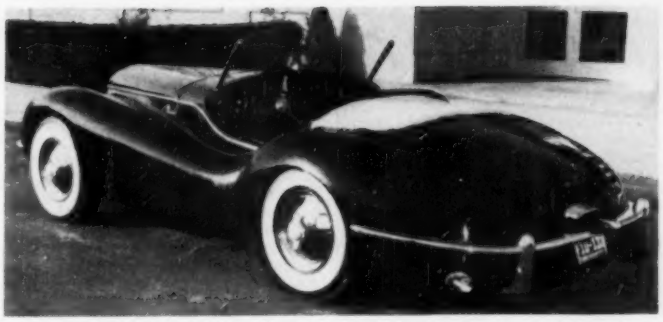
CLEVELAND—A new method of computing potential return on capital invested by metalworking manufacturers in new machine tools has been devised by the National Machine Tool Builders' Association.

Presented in the form of a booklet entitled "Computing Return on Invested Capital, A Study in Machine Tool Arithmetic," the method carries shop computations of annual savings effected by a new machine tool on through the additional computations dealing with depreciation and Federal income taxes, in order to arrive at estimated net return over a ten-year period, the probable profitable life of the new machine.

"This method for the first time combines 'shop arithmetic' with 'upstairs arithmetic' in such a way as to provide a quick answer to financial men trained to thinking in terms of dollars instead of machines," says David Ayr, NMTBA head and president and general manager of The Hendey Machine Co., Torrington, Conn. "It enables the shop superintendent to translate potential increased productivity into potential yield on invested capital."

The back of the booklet consists of a work sheet upon which a machine tool salesman, after securing facts as to the increased productivity and the resultant savings which a machine tool may effect in a customer's plant, can then compute simply and rapidly the potential per cent of annual net return on the money to be invested in the new machine.

***WORCESTER'S NEW MAYOR** is Andrew B. Holmstrom, vice president, Norton Co. He serves as first mayor of this Massachusetts city under its newly adopted council-manager form of government. Worcester citizens, voting for the first time under proportional representation, gave Mr. Holmstrom 2½ times as many votes as his nearest contender among the 152 candidates for the nine-man council.*



***THIS FLASHY JOB**, a 2-seater powered by a Mercury engine, was turned out by DM Nacional, as the . . .*

First Automobile Made in Mexico

MEXICO CITY (McGraw-Hill World News)—One of the most progressive industrial firms in Mexico, DM Nacional, has now turned its talents to automobile manufacturing and the first car has already come off its production line. It is the first automobile ever commercially produced in Mexico.

The initial model is only a two-seater sports car, powered by a Mercury engine, but the company claims a regular production line is also being set up for small five-passenger sedans and that they will be put on the market next June.

May Make Renault or Austin

Although no formal announcement has been made, it is reported that DM Nacional is negotiating for the rights to manufacture, not assemble, either the French Renault or the British Austin.

There are several factors that make Mexican automobile production a rather sound scheme. First is Mexico's present ban on the importation of assembled cars and the limiting of Mexican assembly to some 15,900 cars per year. This leaves quite a market for cars in Mexico—and at good prices.

Can Use 45,000 Cars

It is estimated by the trade that Mexico can use about 45,000 cars per year for the present if they are sold at prices somewhere near U. S. levels. However, the cars coming under quota production from the GM, Ford, Chrysler and Hudson assembly lines in Mexico are selling at least 50% above U. S. prices and in most cases more than that. For example, a Pontiac Chieftain, from Mexican assembly plants, cost one recent buyer 31,000 Mexican pesos or some $3,700.

Thus DM Nacional, hoping to bring its sports car out at 17,000 pesos (about $2,000) will just about match the price of its only mass produced equivalent, the English MG Special.

The small sedan which has not yet been officially announced by DM Nacional's dynamic boss, Antonio Ruiz Galindo, will sell for as low as 12,000 pesos if plans work out. This will be only $1,500 compared to $2,300 for a Ford in Mexico City.

Already Has Presses

The second reason why Mexican automobile production might make sense in the face of otherwise overwhelming economic difficulties is that DM Nacional already has the giant presses which can be used to stamp out body parts. These presses are located in DM Nacional's model plant outside of Mexico City where normally they make just about all the office furniture for the country, plus such items as electric refrigerator shells, kitchen cabinets and sinks, shells for Mexican Bendix washers, and even soda fountains. But there is still a margin of production capacity left, and DM Nacional hopes to fill this by turning out cars.

Political Reasons Given

The third reason why automobile production just might make a go in Mexico is political. Senor Ruiz Galindo is former Secretary of the Economy of the Aleman government, and his relationships with the government are somewhat more than good.

The present DM Nacional car is a sleek streamlined job that hardly lives up completely to its billing as "the first car ever completely produced in Mexico." It was designed by Ing. Jose G. de Parada, a Mexican engineer who studied at MIT in the U. S. and Beaumont college in England. His experience previously has been on custom-built cars.

The Ford Motor Company cooperated by allowing one of its chief mechanics in Mexico to help out with mechanical problems. They will also supply parts for DM Nacional production as required.

Detroit

GM MOTORAMA CROWDS INDICATE AUTO INTEREST STILL KEEN
$30 MILLION PLANNED FOR COMPLETE VAUXHALL RETOOLING

If interest in automobiles is any criterion of the size of the unfilled market, then the predictions of the optimists for automobile sales ahead are conservative. The General Motors MidCentury Motorama proved that. The January exhibit by GM in New York drew record-high crowds which often stood patiently in line for two hours or more to look at the sleek new models.

Attendance shattered last year's mark. During climax points in the surges into the ballroom floor of the Waldorf-Astoria, those lucky enough to get in found themselves unlucky enough that they could see little beyond other people clustered around them.

From the news standpoint the exhibition itself may have been less significant than satellite events which crowded around it. The industrialists' luncheon of Alfred P. Sloan, Jr., chairman of GM, and the press luncheon presided over by Paul Garrett, vice-president, produced worthwhile attitudes and angles. Samplings from the lengthy list of developments:

(1) Sloan before the industrialists: "Deferred demand [for automobiles] will carry over into 1950 to the extent of about 1,500,000 cars. . . . The automotive industry is likely to enjoy in 1950 a volume approaching that of 1949. . . . General Motors has expanded and rehabilitated its production facilities since the end of the war; the added investment amounts to almost one billion dollars."

(2 Wilson before the industrialists: "While there are certain hazards to our prosperity, I expect 1950 to be a very prosperous year, and I see no reason why the next 10 years should not also be increasingly prosperous" —provided several enumerated conditions are achieved.

(3) The coal strike in January was a near-term threat to production. The situation of various steel companies was worsening rapidly, to the point that some would have to be going down in early February. If this continued, it would begin to affect automobile company manufacturing schedules in early March—sooner in the case of some companies.

Compression Ratios to Go Up

(4) Automobile engine compression ratios will go up but slowly—which means that retooling requirements over the years ahead will be steady and sustained, rather than bulging and intense at any particular period. There are indications that in-line six-cylinder engines, like Chevrolet's, may be able to do a high compression job like the V-engines are doing in other lines. However, there are additional valid viewpoints that a V-6 powerplant may be the more effective medium for compression ratios of 10 to 1 and up, rather than in-line sixes.

(5) There is no agreement whatsoever within the engineering staffs of GM as to a choice between torque converter and Hydra-Matic types of transmissions. Each auto division staff has its own ideas. Automatic transmission prices will always be higher than those of standard transmissions.

(6) Revamped freight rates will have little effect on GM plant locations. Fabrication plants will continue to be located close to steel and pig iron sources—ideally inside a ragged circle running "through Buffalo up north of Lansing, around through Grand Rapids, Chicago, back through Indianapolis, Cincinnati, Dayton, Pittsburgh, and back to Buffalo."

(7) GM has no plans at this time to put a small car into production in this country.

(8) During 1949 GM used 4,100,000 tons of steel—about a million more than in 1948.

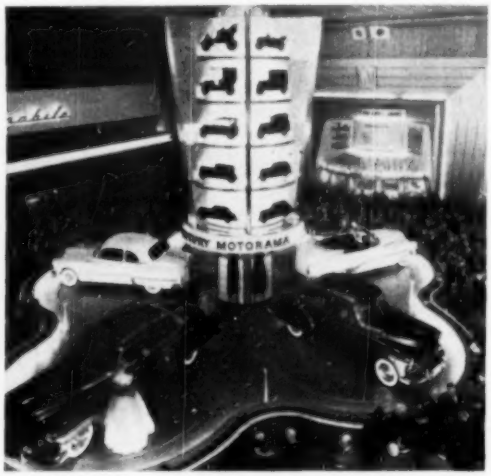
(9) GM export business in 1950 will be off about 30% from 1949.

Retooling Program for Vauxhall

(10) General Motors is planning a retooling program for Vauxhall (its English operation) which will rank among the largest yet undertaken for a British car producer. Plans call for spending of approximatley 10-million pounds, or close to $30 million at today's exchange rates. The objective will be to retool the plant completely, making possible the building of a model with brand new chassis, engine, and body.

(11) And, finally, a bright exchange between C. E. Wilson and a reporter. The reporter asked if there was any thought of turning attention toward a car's use more than toward its looks. Wilson replied: "Well, I think I could say our objective is a blonde that can cook."

ROCKET *engine at GM show automatically split in half*



AUTOMOTIVE PROGRESS *in past half century is dramatized*

Names in the News

David C. Peterson

David C. Peterson has been named director of engineering and manufacturing, Division One, Stewart-Warner Corp., Chicago. Director of engineering since 1946, he is assuming duties relinquished by **George Thomas,** plant manager since 1943. Mr. Thomas has been named production consultant to the senior vice president. Prior to joining Stewart-Warner Mr. Peterson was an engineering consultant to diesel engine manufacturers.

Carl F. Jensen, midwest district sales manager of Shakeproof, Inc., Div. of Illinois Tool Works, Chicago, has just completed a 13-week course in advanced management at Harvard University. He is the sixth Illinois Tool Works executive to participate in this training program, being one of 140 specially selected, experienced managers from American industrial firms qualified to attend.

E. H. Panczner has joined Paul & Beekman, Inc., Philadelphia, as vice president, works manager, and director. He was also made a director of Conestoga Mfg. Co. He was formerly manager for P. R. Mallory Co., Inc., Indianapolis.

R. G. Gehlsen has been named sales manager, Mines Equipment Div. of Joy Mfg. Co., Pittsburgh. **H. B. Zeppenfeld** has been named manager, industrial sales, for the division.

Arthur L. Larson has been named assistant to the sales manager and manager, Sales Inquiries Div., Falk Corp., Milwaukee. Other appointments: **William J. Urban,** manager of coupling sales; **Don K. Lambert,** manager of distributor sales. Appointed to Falk district sales office staffs are **Nile E. Sweet,** Detroit; **Harold C. Fleischer,** New York; and **Elliot G. Heuser,** Wisconsin.

Eugene A. Brunner has been named assistant secretary and treasurer of American Cladmetals Co., Carnegie, Pa.

Gene DeMambro has been elected president of Lincoln Park Industries, Inc., Jamestown, N. Y. He has been vice president of the corporation and general manager of the Curtis Machine Div.

John Jeppson, asst. secretary and a director of Norton Co., Worcester, Mass., has been named works manager of the Abrasive Div. He was formerly supt. of Plant 7. **Milton F. Beecher** has been elected vice president in charge of research and development. **Ralph F. Gow,** executive vice president of Norton Co., was elected vice president of Norton Pike Co., and **Ralph M. Johnson,** vice president in charge of sales, was named to the Norton Pike Co. board. **Frank G. Gifford,** manager of wheel plants at Norton Co., now expands his responsibilities to include all manufacturing operations in Plant 7 previously under separate management of Mr. Jeppson. **John R. Bergman** becomes the new supt. of Plant 7.

Hans Ernst

Hans Ernst, director of research for Cincinnati Milling Machine Co., has been selected Cincinnati's outstanding engineer of 1949-50 by the Technical and Scientific Societies Council of Cincinnati. The award, a scroll citation, was presented Feb. 3 for Mr. Ernst's "outstanding contribution to the development and well being of the profession, and his contribution to human welfare." Mr. Ernst has been in charge of research and development work at Cincinnati for 24 years.

L. D. Seymour has been elected a director and secretary-treasurer, and is general manager of the newly formed Marshall Richards Machine Co., Inc., Trenton, N. J., American subsidiary of Marshall Richards Machine Co., Ltd., of England.

R. J. Cowden has been named sales manager for engines and related products, Lycoming-Spencer Div., Avco Mfg. Corp., Williamsport, Pa. He will direct sales activities for Lycoming's complete line of aircraft engines and also serve as manager of military contracts. He served 17 years with Lycoming, from 1927 through 1944, in purchasing, engineering and sales capacities. From 1945 through 1947 he handled contract and service engineering for the American Propeller Corp. and later served as sales manager for the Avco Tool and Machine Div., Toledo.

E. H. Panczner

John Jeppson

R. J. Cowden

R. B. Haynes

Frank Sullivan

R. B. Haynes has been named to the newly created post of vice president in charge of manufacturing of the various divisions of Dana Corp., Toledo. Mr. Haynes, a one-time journeyman toolmaker, joined Spicer Mfg. Corp., now a Dana division, in 1935, first working on special assignments, then becoming successively master mechanic, equipment manager, and works manager of the Toledo plant.

Charles W. Coffin has been named sales manager of Reed-Prentice Corp., Worcester, Mass. **J. D. Sherman** has been named sales engineer in the New York office. He was formerly with Norton Co., Worcester.

P. H. McManus has been named general sales manager of Templeton, Kenly & Co., Chicago. He has been with the company for 31 years.

Dr. Zay Jeffries, vice president of General Electric Co. in charge of the Chemical Dept., Pittsfield, Mass., has retired, as has **Martin L. Sloan,** vice president and, until 1948, general manager of the G-E Lamp Dept., Nela Park, Cleveland. Dr. Jeffries has been a member of General Electric's four-man committee which administers the Nucleonics Project. He began service with GE in 1914 as a consultant to the National Lamp Works. From 1932 to 1936 he was president of Carboloy Co., Inc., a GE affiliate, and since then has been a member of the board. In 1936 he became technical director, Lamp Dept., and in 1945 he was elected a vice president and placed in charge of the newly-formed Chemical Dept. Mr. Sloan joined GE in 1910 as commercial engineer for National Lamp Works. In 1914 he was made asst. general manager of manufacturing at Nela Park, became manager of manufacturing in 1921. He was named asst. manager of the Lamp Dept. in 1930, manager in 1942, and was elected vice president and general manager in 1945. One of Mr. Sloan's best-known achievements involved the introduction of the sealed beam headlamp for automobiles.

Frank Sullivan has joined Chicago-Latrobe, Chicago, as sales and service representative for the New England territory.

George Kendall has been named chief engineer, Wickes Bros. Div. of Wickes Corp., Saginaw, Mich.

William H. Chamberlain, senior legal counsel of Thompson Products, Inc., Cleveland, has been elected secretary of the company.

Fred W. Neale, who has been serving as acting chief industrial engineer for Boeing Airplane Co., Seattle, has been appointed to that position in a permanent capacity.

Business Items

Die Mold Engineering Co., a new business owned by David F. Shade, will make dies, tools, and fixtures at its Glendale, Calif., plant.

Miller Machine Works, a machine shop for general work, has been opened in Los Angeles by Fred A. Miller.

Toledo Perforating Machine Co., Toledo, has been incorporated to manufacture and deal in perforating machines and tools.

American Drill Bushing Co., Los Angeles, has opened a new, modern office headquarters and manufacturing plant at 5107 Pacific Blvd.

Hartford-Empire Co.'s Henry & Wright Div., Hartford, Conn., has acquired the Pickering Governor Co. of Portland, Conn., oldest manufacturer of governors in the United States.

Randall Graphite Bearings, Inc., Chicago, has purchased the foundry and machine shop of Shook Bronze Corp., Lima, Ohio, to be operated as the Shook Bronze Div. The machine shop will be augmented by a transfer of the Randall Chicago plant to Lima.

Automatic Steel Products, Inc., Canton, Ohio, is negotiating for expansion of its automotive accessory line through an agreement with Linmar Products Corp., Chicago. Plans call for manufacture of Linmar automobile water pumps in the Linmar plant, with sales being made by Automatic's sales organization. The Linmar name would be retained for the pump line.

Lewis Welding & Engineering Corp., Bedford, Ohio, has purchased the Euclid, Ohio, plant and equipment of Joy Mfg. Co., Pittsburgh. The new plant will be organized as a separate manufacturing entity and will do machine work and machine assembly work as the Breckenridge Machine Div. of Lewis Welding. Approximately 150 employees will be added to the Lewis payroll. Located at 23000 St. Clair Ave., the new Lewis plant for years was an established Cleveland concern known as the Breckenridge Machine Co. Joy has operated it since 1946. Lewis Welding will continue to handle Joy Mfg. work at the Breckenridge plant on a contract basis until the Joy concern is prepared to absorb such work in other of its six factories. There will be no change in the Bedford operations of Lewis Welding.

Bay State Abrasive Products Co., Westboro, Mass., has moved its Detroit branch office and warehouse to 880 Lawndale Avenue, Detroit 9.

U. S. Reduction Co., Chicago, has purchased Toledo Smelting & Refining Co. at public auction for $82,750. The Toledo plant will do aluminum smelting.

Obituaries

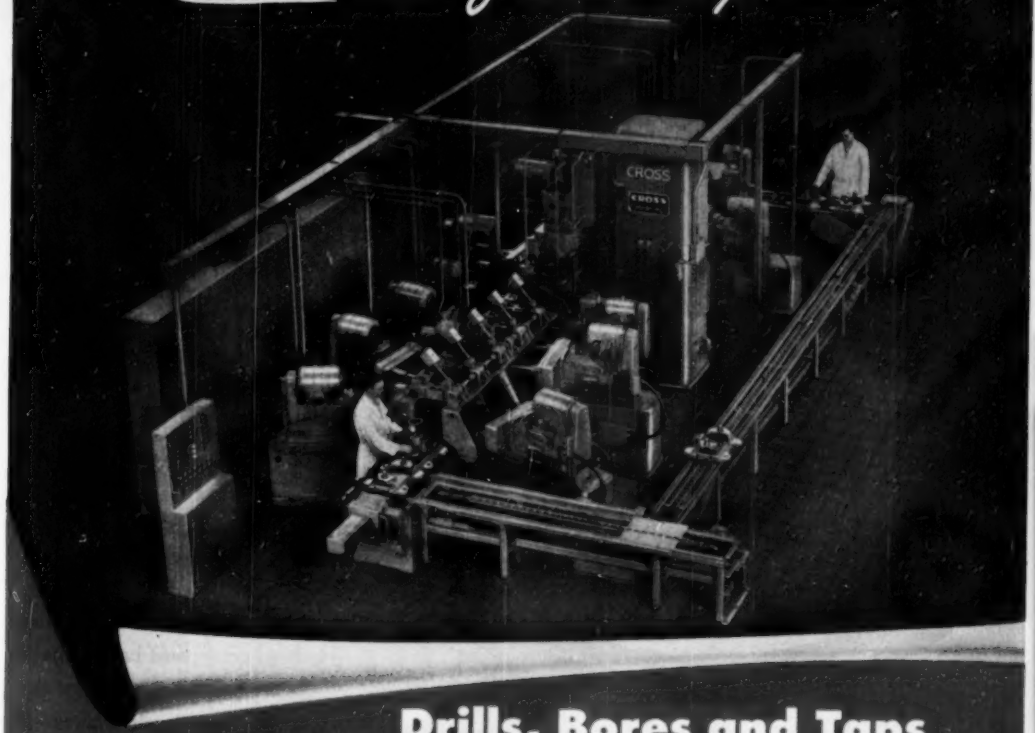
Charles Tietzmann, 76, president of Tietzmann Tool Corp., Englewood, Ohio, died Dec. 26. Before founding his own company in 1926 he had worked as a toolmaker with National Cash Register Co.

William B. Knight, president and founder of W. B. Knight Machinery Co., St. Louis, died Jan. 7.

J. Russell Putnam, 69, mechanical engineer for U. S. Time Corp., Waterbury, Conn., until his retirement two years ago, died Jan. 16.

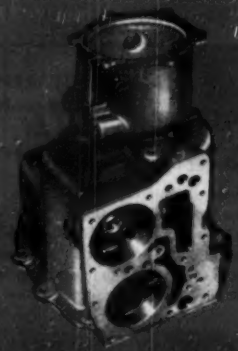
Emerson H. Fairchild, 59, head of E. H. Fairchild Co., New Orleans, until his retirement late in 1949, died Jan. 1. His firm was sales representative for Automatic Transportation Co., Chicago, in the Louisiana, Mississippi, and Alabama territory. He had worked for Automatic in Ohio, and then was southern sales manager, covering nine states, prior to organizing his own firm.

Another Transfer-matic by Cross



Drills, Bores and Taps

Automatic Transmission Cases



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★ Palletized work carriers.
★ 15 progressive work stations.
★ Built-in chip conveyors.
★ Automatic cycle interruption if critical tools are broken or if improperly set for depth.
★ Simple cam clamping.
★ Positive mechanical interlocks between stations for locating and clamping.

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SPECIAL MACHINE TOOLS

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING

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HACKSAWS, BAND SAWS and BAND KNIVES
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NEW Starrett Hacksaw and Band Saw Catalog helps you choose the right hacksaw or band saw for any cutting job.

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Make STARRETT Your Headquarters For All Precision Cutting

Starrett now meets all requirements for Hacksaws, Band Saws and Band Knives. Precision made by the World's Greatest Toolmakers in a new, modern building with latest facilities, advanced techniques and highest quality standards. Finest steel, scientific heat treatment plus precision manufacturing combine to make STARRETT your best buy.

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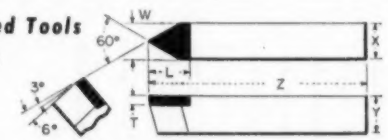
American Machinist
REFERENCE BOOK SHEET

Carbide Insert and Tool Standards . . . IV

Developed by the Carbide Industry Standardization Committee

Style E Brazed Tools

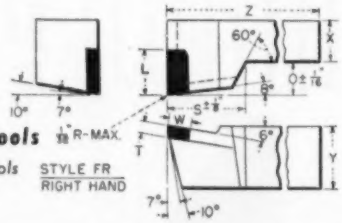
60° nose angle



CATALOG NUMBER	SHANK DIMENSIONS			TIP CATALOG NUMBER
	Width	Height	Length	
	X	Y	Z	
E 5	5/16	5/16	2 1/4	6080
E 6	3/8	3/8	2 1/2	6100
E 8	1/2	1/2	3 1/2	6200
E 10	5/8	5/8	4	6240
E 12	3/4	3/4	4 1/2	6340

Style F Brazed Tools

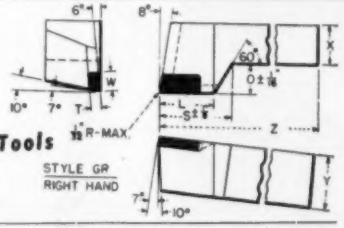
Offset, end-cutting tools STYLE FR / RIGHT HAND



Catalog Number		Shank Dimensions					Tip Catalog Number
Style	Style	Width	Height	Length	Offset	Lgth. of Offset	
FR	FL	X	Y	Z	O	S	
FR 12	FL 12	3/4	3/4	4 1/2	5/8	1 3/8	2310
FR 16	FL 16	1	1	7	3/4	1 1/8	3390 / 4390
FR 20	FL 20	1 1/4	1 1/4	8	3/4	1 3/8	3460 / 4460
FR 44	FL 44	1/2	1	6	1/2	1	2260
FR 55	FL 55	5/8	1 1/4	7	5/8	1 1/4	3360 / 4360
FR 64	FL 64	3/4	1	6	5/8	1 5/16	3380 / 4380
FR 85	FL 85	1	1 1/4	8	3/4	1 1/2	3460 / 4460
FR 86	FL 86	1	1 1/2	8	3/4	1 9/16	3510 / 4510

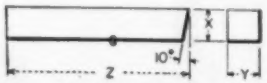
Style G Brazed Tools

Offset, side cutting STYLE GR / RIGHT HAND



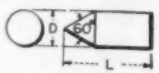
Catalog Number		Shank Dimensions					Tip Catalog Number
Style	Style	Width	Height	Length	Offset	Lgth. of Offset	
GR	GL	X	Y	Z	O	S	
GR 12	GL 12	3/4	3/4	4 1/2	5/8	1 3/8	2310
GR 16	GL 16	1	1	7	1/2	1 5/8	3390 / 4390
GR 20	GL 20	1 1/4	1 1/4	8	3/4	1 3/4	3460 / 4460
GR 44	GL 44	1/2	1	6	1/4	1 1/8	2260
GR 55	GL 55	5/8	1 1/4	7	5/8	1 1/8	3360 / 4260
GR 64	GL 64	3/4	1	6	1/2	1 3/8	3380 / 4380
GR 85	GL 85	1	1 1/4	8	1/2	1 5/8	3460 / 4460
GR 86	GL 86	1	1 1/2	8	1/2	1 5/8	3510 / 4510

Square Boring Bits

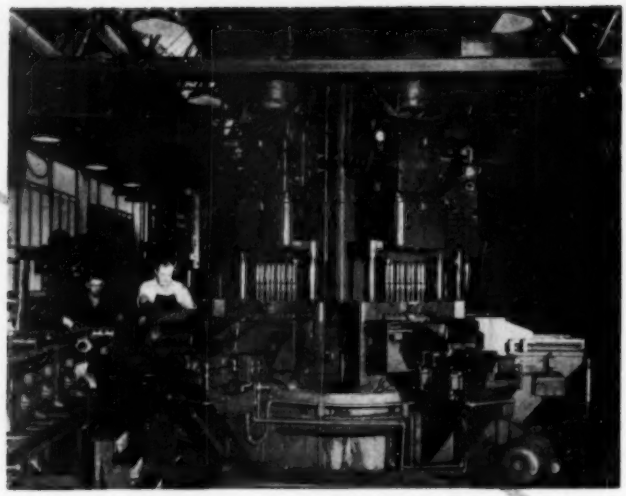


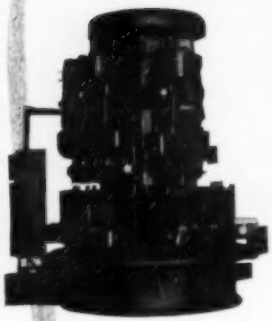
Designation	Size		
	X +0.000 −0.010	Y +0.000 −0.005	Z
SQ-310	3/16	3/16	1 1/4
SQ-410	1/4	1/4	1 1/4
SQ-512	5/16	5/16	1 1/2
SQ-614	3/8	3/8	1 3/4

Standard Center Inserts



Designation	Insert Size		For Use With Taper Number		
	D	L	Morse	B & S	Jarno
CT-40	1/4	7/32	1	5, 6	4, 5
CT-50	5/16	9/16	2	7	—
CT-60	3/8	11/16	—	8	6, 7
CT-80	1/2	7/8	3, 4	9, 10	8, 9, 10, 11
CT-100	5/8	1 1/16	5, 6	11, 12	12, 13, 14
CT-120	3/4	1 1/4	—	13	—
CT-140	7/8	1 3/8	7	—	—





FOOTBURT *center column machines*

● Footburt center colum type machines are being used to machine automotive cylinder blocks, cylinder heads, flywheels, steering spindles and many smaller parts made in large quantities. Work holding fixtures mounted on an index ring table are progressed from station to station. With this design several drilling, reaming, boring or tapping heads are mounted on one machine frame, thus saving a large amount of floor space and greatly reducing equipment cost compared with the use of separate machines for each operation. This is representative of Footburt "Engineering for Production". We will be glad to work with you on your problems.

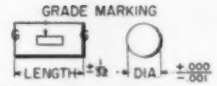
THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building

A TIME TESTED LINE OF MACHINE TOOLS

FOOTBURT
MACHINE TOOLS

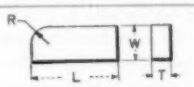
ENGINEERED FOR PRODUCTION

Carbide Insert and Tool Standards...V



CARBIDE CYLINDERS FOR TURNING AND BORING

Designation	Size
SC-33	3/32 dia. x 3/8
SC-34	3/32 dia. x 1/2
SC-44	1/4 dia. x 1/2
SC-46	1/4 dia. x 3/4
SC-48	1/4 dia. x 1
SC-55	5/32 dia. x 5/8
SC-64	3/16 dia. x 1/2
SC-66	3/16 dia. x 3/4
SC-69	3/16 dia. x 1 1/8
SC-77	7/32 dia. x 7/8
SC-88	1/4 dia. x 1
SC-810	1/4 dia. x 1 1/4
SC-1010	5/16 dia. x 1 1/4
SC-1212	3/8 dia. x 1 1/2
SC-1612	1/2 dia. x 1 1/2



REAMER TIPS

Tip Style No.	T	W	L	R
RT-1	1/32	1/16	1/2	1/4
RT-2	5/64	3/32	1/2	1/4
RT-3	3/64	3/32	11/16	1/4
RT-4	1/16	3/16	11/16	1/4
RT-5	5/64	3/16	7/8	1/4
RT-6	3/32	5/16	7/8	5/16
RT-7	1/16	13/64	3/4	5/16
RT-8	1/16	17/64	3/4	3/8
RT-9	1/16	5/16	3/4	3/8
RT-10	1/16	3/8	3/4	3/8
RT-11	5/64	5/16	1	1/4

Tolerances on Tip Dimensions:
+0.015 —0.000 up to 3/8 in.
+0.20 —0.000 over 3/8 through 1 in.
+0.040 —0.000 over 1 through 2 in.

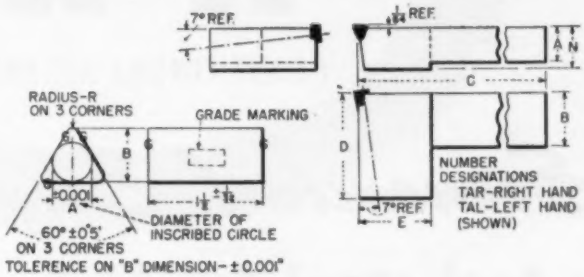
SOLID CARBIDE SQUARES

Designation	Size
SQ-310	3/16 square x 1 1/4
SQ-410	1/4 square x 1 1/4
SQ-512	5/16 square x 1 1/2
SQ-614	3/8 square x 1 3/4

STANDARD CARBIDE SCRAPER TIPS

Tip Style No.	T	W	L
ST-1	5/64	3/32	1
ST-2	1/16	1/4	1
ST-3	3/32	1/4	1
ST-4	1/8	1/4	1 1/4

SOLID TRIANGULAR INSERTS AND TOOLHOLDERS



DIMENSIONS OF TRIANGULAR INSERTS

Diameter of Inscribed Circle A	Height B	† Standard Corner Radius R	Non-Standard Corner Radii for Each Insert Size			
1/4	0.344	1/32	R = 0 B = 0.375	1/64 0.359	3/64 0.328	1/16 0.313
3/8	0.516	3/64	R = 0 B = 0.563	1/64 0.547	1/32 0.531	1/16 0.500
1/2	0.688	1/16	R = 0 B = 0.750	1/32 0.719	1/8 0.625	— —

† Standard corner radii specified are the standard dimensions and will be carried in stock by the carbide fabricators. Inserts with other specified corner radii (non-standard) will not be carried in stock but will be furnished upon request.

STYLE NUMBERS FOR TRIANGULAR INSERTS

Dia. of Inscribed Circle	Corner Radii — Ground Inserts						Unground Inserts Without Radius ‡
	0	1/64	1/32	3/64	1/16	3/32	
1/4	TB 8120-G	TB 8121-G	TB 8123-G	TB 8123-G	TB 8124-G	—	TB 812
3/8	TB 12120-G	TB 12121-G	TB 12122-G	TB 12123-G	TB 12124-G	—	TB 1212
1/2	TB 16120-G	—	TB 16122-G	TB 16123-G	TB 16124-G	TB 16128-G	TB 1612

‡ On all unground inserts grinding stock shall be provided.

DIMENSIONS AND TRIANGULAR INSERTS FOR STYLE TAR AND TAL TOOLHOLDERS

Catalog Number		Shank Dimensions						Insert Dimensions		Insert Designation Number †
Style TAR	Style TAL	A	B	C	D Max.	E Max.	N Max.	Inscribed Circle Dim.	Lgth.	
TAR 54	TAL 54	5/8	1	6	2	1 1/4	3/4	1/4	1 1/2	TB 8120-G
TAR 55	TAL 55	5/8	1 1/4	6	2	1 1/4	3/4	1/4	1 1/2	TB 8120-G
TAR 63	TAL 63	3/4	3/4	6	2	1 1/4	3/4	1/4	1 1/2	TB 8120-G
TAR 64	TAL 64	3/4	1	6	2	1 1/4	3/4	1/4	1 1/2	TB 8120-G
TAR 65	TAL 65	3/4	1 1/4	6	2	1 1/4	3/4	1/4	1 1/2	TB 8120-G
TAR 84	TAL 84	1	1	8	2	1 7/16	1	3/8	1 1/2	TB 12120-G
TAR 85	TAL 85	1	1 1/4	8	2	1 7/16	1	3/8	1 1/2	TB 12120-G
TAR 86	TAL 86	1	1 1/2	8	2 1/4	1 7/16	1	1/2	1 1/2	TB 16120-G

† Designation numbers cover inserts with zero corner radius. Designation numbers for inserts with other corner radii are shown above.
Shank width A is subject to a tolerance of +0.000 —0.010 in. for 1-in. shanks and less, and +0.000 —0.015 in. for shanks over 1 in.

A-H5

(5 PCT CHROME AIR-HARDENING)

Economical, Easy Machining

a tool steel for high-production jobs

A-H5 is the backbone of this high-production die which blanks and punches sheet steel of 0.180-in. thickness. A-H5 assures long production between grinds, holds a durable cutting edge, and has high resistance to distortion in heat-treatment.

And that's not all. A-H5 provides the greater safety of air-hardening; and it wears longer and has better distortion-resistance than low-alloy, oil-hardening grades. A-H5 has deep-hardening properties in large sections, combined with shock-resistance equal to that of carbon tool steels. And with all these advantages, it's still easy to machine—it anneals to less than 212 Brinell.

A-H5 is an economical grade, because it's ideal for many tools and dies that would ordinarily call for high-carbon, high-chrome steel, such as Lehigh H. Demand for A-H5 is growing fast, for it has the high wear-resistance and durable cutting edges for high-production jobs.

Give A-H5 a fair trial and you'll find your toolroom can't get along without it.

Wide ranges of sizes for prompt delivery

Large stocks of A-H5 are available for quick delivery from Bethlehem tool-steel distributors everywhere.

HEAT-TREATMENT OF A-H5

Typical Analysis:	C	Mn	Cr	Mo	V
	1.00	0.60	5.25	1.10	0.25

Annealing: Pack, heat to 1650 F, slow furnace-cool, Brinell 212 max

Preheating: 1200 to 1250 F, prior to hardening

Hardening: 1775 F, air-quench

Tempering: 350 to 400 F, Rockwell C 60 to 62

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation

Export Distributor:
Bethlehem Steel Export Corporation

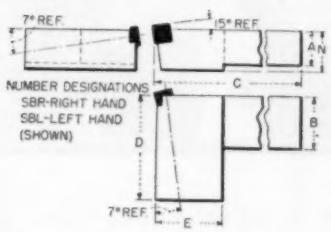
BETHLEHEM STEEL

SUPERSONIC TESTED

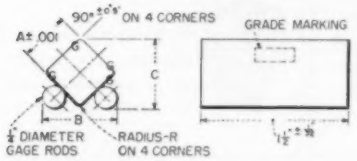
Bethlehem Tool Steel

Carbide Insert and Tool Standards...VI

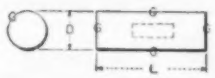
Styles SBR and SBL Insert Toolholders



SOLID SQUARE INSERT



SOLID CYLINDRICAL INSERTS

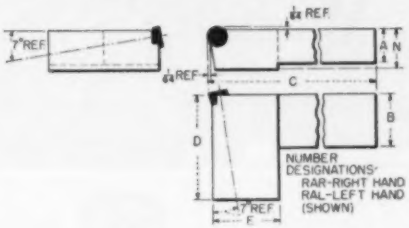


Designation	D	L
SC-1212	3/8	1 1/2
SC-1612	1/2	1 1/2

Correction

In "Carbide Insert and Tool Standards—II", (*AM*-Jan. 23, 1950, p. 273) the cuts are interchanged for terminology of standard brazed tools and Style A brazed tools. In addition, the heading for Style A brazed tools should read "side cutting edge angle 0°."

Styles RAR and RAL Insert Toolholders



DIMENSIONS OF SQUARE INSERTS

Nominal Size	Measurement	Measurement	Standard Corner Radius †	Non-Standard Corner Radii For Each Insert Size		
A	B	C	R			
3/8	0.692	0.598	1/32	R = 0 B = 0.692 C = 0.611	3/64 0.692 0.592	1/16 0.692 0.585
1/2	0.780	0.724	3/64	R = 0 B = 0.780 C = 0.743	1/32 0.780 0.730	1/16 0.780 0.717
3/4	0.957	0.983	1/16	R = 0 B = 0.957 C = 1.009	1/32 0.957 0.996	1/8 0.957 0.957

† Standard corner radii specified are the standard dimensions and will be carried in stock by the carbide fabricators. Inserts with other specified corner radii (non-standard) will not be carried in stock but will be furnished upon request.

STYLE NUMBERS FOR SQUARE INSERTS

Size	Corner Radii — Ground Inserts					Unground Inserts Without Radius ††
A	0	1/16	3/64	1/32	1/64	
3/8	SQ 12120-G	SQ 12122-G	SQ 12123-G	SQ 12124-G	—	SQ 1212
1/2	SQ 16120-G	SQ 16122-G	SQ 16123-G	SQ 16124-G	—	SQ 1612
3/4	SQ 24120-G	SQ 24122-G	—	SQ 24124-G	SQ 24128-G	SQ 2412

†† On all unground inserts grinding stock shall be provided.

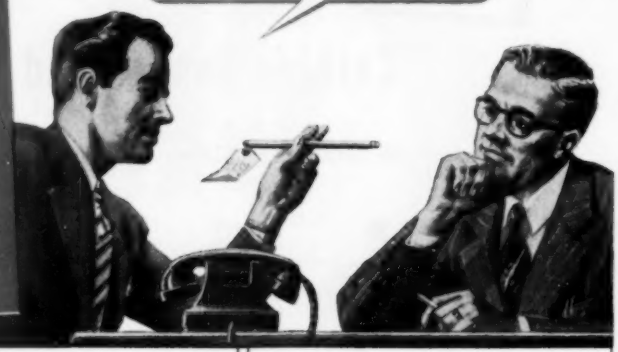
DIMENSIONS AND INSERTS FOR TOOLHOLDERS RECEIVING SQUARE OR ROUND INSERTS

Shank Dimensions						Insert Dimension		Square—Insert Holders		Insert No. †	Round—Insert Holders		Insert No.
A	B	C	D Max.	E Max.	N Max.	Dia. or Sq.	Length	Style SBR	Style SBL		Style RAR	Style RAL	
5/8	1	6	2	1 1/4	3/4	5/8	1 1/2	SBR 54	SBL 54	SQ 12120-G	RAR 54	RAL 54	SC-1212
5/8	1 1/4	6	2	1 1/4	3/4	3/8	1 1/2	SBR 55	SBL 55	SQ 12120-G	RAR 55	RAL 55	SC-1212
3/4	3/4	6	2	1 1/4	3/4	3/8	1 1/2	SBR 63	SBL 63	SQ 12120-G	RAR 63	RAL 63	SC-1212
3/4	1	6	2	1 1/4	3/4	3/8	1 1/2	SBR 64	SBL 64	SQ 12120-G	RAR 64	RAL 64	SC-1212
3/4	1 1/4	6	2	1 1/4	3/4	3/8	1 1/2	SBR 65	SBL 65	SQ 12120-G	RAR 65	RAL 65	SC-1212
1	1	8	2	1 7/16	1	1/2	1 1/2	SBR 84	SBL 84	SQ 16120-G	RAR 84	RAL 84	SC-1612
1	1 1/4	8	2	1 7/16	1	1/2	1 1/2	SBR 85	SBL 85	SQ 16120-G	RAR 85	RAL 85	SC-1612
1	1 1/2	8	2 1/4	1 7/16	1	*	1 1/2	SBR 86	SBL 86	SQ 24120-G	RAR 86	RAL 86	SC-1612

* 1/2-in. diam. or 3/4-in. square, according to type of toolholder.
† Designation numbers cover inserts with zero corner radius. Designation number for inserts with other corner radii are shown above. Shank width *A* is subject to a tolerance of 0.000-0.010 in. for 1-in. shanks or less and 0.000-0.015 in. for shanks over 1 in.

Said Mr. Hamilton* to Mr. Jones**

*Typical New Britain Sales Engineer
**Typical Industrial Executive



I only wish I could see my way clear to buy some new equipment. Some of my stuff's pretty old. What do they save on a job like that?

Well, first off they save operators. Then there's floor space and maintenance. Of course, you've got to consider the savings made on tooling and set-up of five machines against one. All in all they make the piece a lot cheaper on one automatic . . . and maintain the production rate and quality, too.

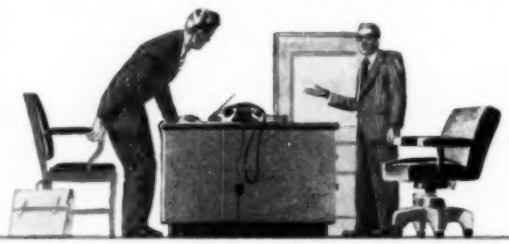
How much down-time for loading? That piece is over a foot long.

We licked that problem with an automatic, magazine-fed stock reel. It automatically loads all six spindles in less than a minute.

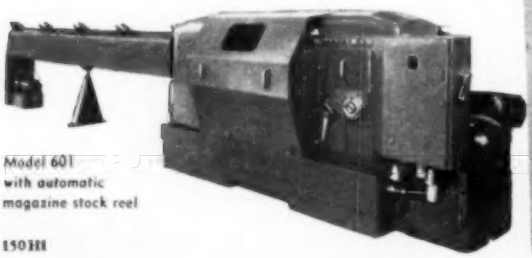
That sort of performance is impressive. I've been reading that our national average age of machines is on the way up again.

And we can't maintain the productivity we must have with over-age machines. This "modernize or die" business is no mere slogan!

What say we take a stroll through the shop right now. You might spot a job where we could save with automatic methods.



Call on your New Britain Sales Engineer to help you discover profit opportunities in metal cutting. Meanwhile, let us send you "It Can Be Done" with up-to-date cost histories on specific pieces.



Model 601 with automatic magazine stock reel

150III

NB

NEW BRITAIN

Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

TALKING SHOP

New Ideas

GE HAS DEVELOPED an electronic torch, combining high-frequency radio signals and various gases, to create temperatures higher than 3,370 C (6100 F). That's enough to cut holes in firebrick or to melt tungsten. There's no commercial application yet . . . Copper in paste form has been developed by Metals Refining Co., Hammond, Ind., a division of Glidden Co. The idea is to speed furnace copper brazing. One form of the paste has a synthetic petroleum base, the other a base that doesn't change viscosity with temperature . . . Nash has built the prototype of a car to sell in the $1000 price range, using a low-horsepower foreign engine, and is asking buyers what they think of it—a new idea in pretesting. According to reports, no dies have been made, and this is not the car Nash will introduce this spring. But it is a stab at finding out whether the buyer really wants a low-priced, low-power car—which thus far has been replaced by opinions of automotive manufacturers.

Half Century

FIFTY YEARS of change is a popular theme, it seems. The newspapers and popular magazines, in their first issues of the new year, compare 1900 and 1950. But all the old-timers (including the Veep) recall the pitched battle in which the erudite finally convinced the common men 50 years ago that 1900 was really the last year of the Nineteenth Century. (You can't count to 100 without putting 100 itself in.)

Women's Home Companion compares household furnishings of 1900 and 1950 in photographs. We felt that drawing the picture of 50 years ago gave contrast enough. *Life* has a "Mid-Century Issue," tracing in pictures the changing American scene. Newspapers devote various feature spots to it. This jumping the gun leads us to wonder what we all do next January.

Incidentally, although each of us approached the problem differently, all of us were impressed by the tremendous advances in our respective fields. But only *Companion* made a prediction—that atomic power might be making our lives easier in the year 2000. In 1900, the predictions favored the automobile, a similar not-unmixed blessing, lethal unless it's kept under rigid control.

Planer Facts

PLANER OPERATORS usually assume that a long, thin flat plate should be supported approximately a quarter of its length from each end in order to assure flat planing. According to William Coomey, general superintendent of Rice Barton Corp., the proper distance is two-ninths of the length of the piece from the ends. Primary support should be at these points and secondary support should be at the ends and in the middle. The first cut is taken on one side to remove the skin, then the piece is turned over, the skin removed on the other side and the finishing cut taken. Then the piece is turned over again, leveled carefully, and the finishing cut taken on the original side. If leveling is done carefully, this will result in a flat planing job.

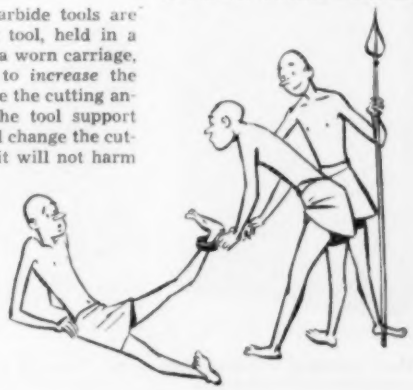
Twist

EXACT ANGLES for carbide tools are essential. A turning tool, held in a worn toolpost or on a worn carriage, will twist sidewise to *increase* the side relief and reduce the cutting angle. Thus play in the tool support unit or high load will change the cutting efficiency—but it will not harm the tool. On a planer or shaper, however, the heel of the tool will twist toward the work under the same conditions, *decreasing* the side relief and causing the heel to rub and the cutting edge to flake.

In either case, recommended tool angles must be modified to assure proper cutting efficiency.

Age of Copper

COPPER, a thousand years before Christ, was the service metal of the world, and the coinage of the common people. According to Mika Waltari in the current best seller, "The Egyptian," the lower classes were stripped of bangles and armlets to forge spear and arrow points every time one of Egypt's frequent wars came along. It's reminiscent of the scrap drives that stripped jallopies of bumpers within the past decade. Now it's steel shortage that's critical, then it was copper shortage. But on the horizon then—literally and figuratively—was steel, for Egypt's spies reported a shiny white metal the Hittites were getting and forging into knives and spear points that could turn the edge of any copper blade. Waltari says it was worth a man's life to mention the metal, and only a few knives got out to foreigners. One was a knife presented to King Tutankhamen — which occasioned considerable comment when it was found in his tomb a few years back. Egypt beat the Hittites, though —not enough steel—just as Hitler didn't have enough production capacity to withstand flying monsters of a newer material—aluminum.



New Shop Equipment

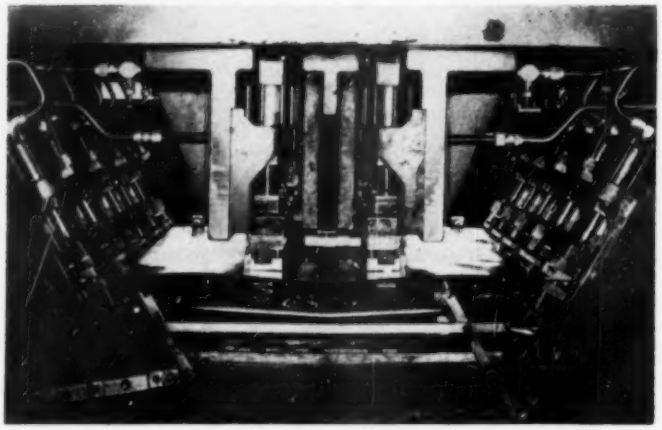


Fig. 1—Hydraulic unit stamps five Prestole thread grips on each side of sheet and two rows of plain holes in the center as . . .

Punch Press Process Makes Nutless Fasteners

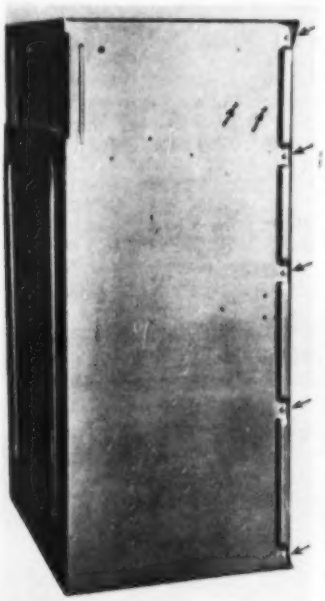


Fig. 2—Sheet, Prestolized in hydraulic unit, is formed into refrigerator liner

Prestolizing is a process for making fasteners by punching cone-shaped holes in sheet metal. Formed to engage screw threads of all popular sizes, the holes can be stamped, by ordinary punch press, into any light-to-medium gage metal. Fasteners can be stamped directly into panels, brackets, flanges, and other parts of an assembly. Tools, dies, and license are supplied by the Prestole Co. and the customer does the stamping. Blanking, punching, and forming of integral fasteners is accomplished at one stroke of the press.

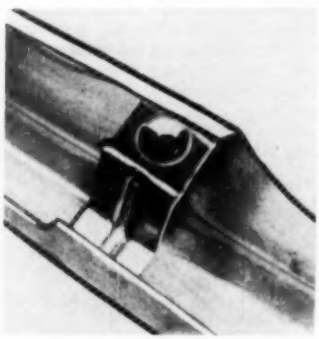
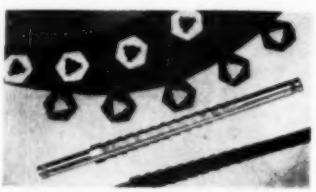


Fig. 3—Prestole thread grip is formed in bracket of radiator grille assembly

Multiple-punch operations can be done on hydraulic units (Fig. 1). Prestolizing dies are installed in each of the piercing stations and, at one operation of the machine, Prestoles are formed simultaneously at the proper locations. Standard Prestole tools, which compensate for enamel "buildup," are used in this case. Manufacturers say these Prestole impressions do not fill up with enamel, require wiping, or cause crazing or chipping when screws are tightened into them.

Where Prestolizing is not feasible, the Prestole Corp. supplies the same conical thread grip in separate units, in a wide variety of shapes and sizes, for hand or mechanical application. The separate fasteners, designed with the same basic thread grip, are made of mild steel and other metals and require no heat treating. Engineering service is provided to determine whether the process is applicable to the product.

Prestole Corp., 3135 Bellevue Rd., Toledo 6, Ohio.

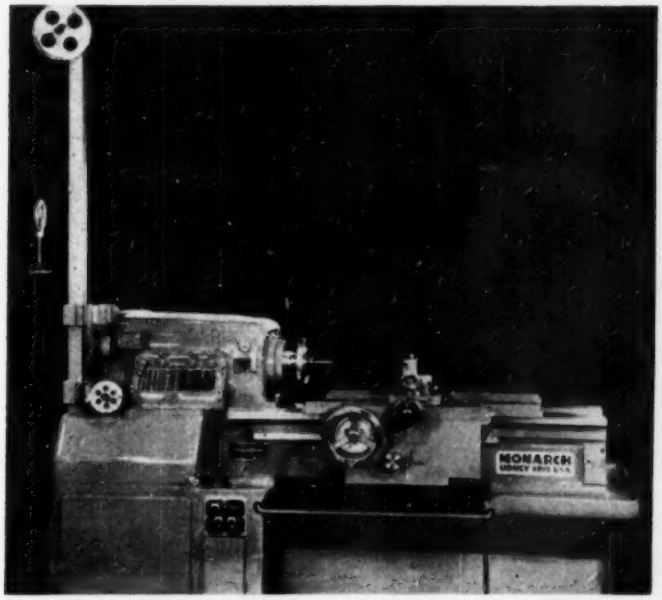


Glenny Push Broach Cuts Three Keyways With Single Pass

Glenny three-keyway broaches can cut one, two, or three keyways in a single pass to meet individual job requirements. Glenny bushing-type adapters, however, cannot be utilized with the new series LK broach to cut keyways in bores larger than broach diameter. The broach has interchangeable blades which are adjustable for depth of cut. They can be furnished in sizes ranging from 5/16 to 1½ in. in increments of 1/32 in. Blade widths range from 1/16 to ⅜ in., depending upon broach diameter.

The Kase Machine Co., 18322 Buffalo Ave., Cleveland 19, Ohio

Materials and Parts



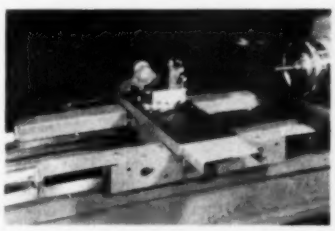
All of the mechanism common to a standard lathe has been removed from the apron except the hand wheel and rack pinion on this . . .

Lathe Adapted for Machinability Testing at Constant Tool Pressure

The design of this lathe, for testing the machinability of free-cutting steel, is based upon the finding that when a given pressure is applied to the cutting tool, steels of different machining quality cut at different rates. This machine differs from standard lathes in three particulars. First, the tool carriage is disconnected from the fixed-feed mechanism and is mounted on anti-friction bearings. Secondly, it is designed to apply a predetermined tool pressure. Thirdly, it is equipped with a mechanical counter for recording the number of spindle revolutions and to measure tool travel.

The result is a unit for constant-pressure lathe testing, said to make practical the selection of a bar of stock and determination from it of the probable machinability for the entire lot.

Most tests are made on ⅞-in. bars. The tool is set for a ⅛-in.deep cut and a 6-lb weight is applied horizontally. Through a system of three pullies and some 0.031-in.-dia piano wire, extending from a drum behind the handwheel, a force of 80 lb is applied to the tool. (The pulley system pro-



Special toolholder permits adjustment of tool by taper and wedge so that cutting edge is perpendicular to direction of tool travel

...INCLUDING

Drillpress equipped with floating drive and ground steel spindle is available in both bench and floor models .....page 68

One-point presses in 500-ton capacities and larger are built with reduced headroom .....page 133

Midget press is equipped with belt tension stop to take weight load off the V-belt.....page 134

Bar-bending machine handles 1¼-in. bars making 6 to 20 bends per min .....page 136

Double-crank gap press is single geared and equipped with an electrically controlled air friction clutch .....page 84

Hand lapping machine is adaptable for either flat or cylindrical work .....page 140

Automatic roll marker permits die marking of screw-machine parts during machine cycle..page 142

...and in Feb. 20

Fourteen- and 16-in. plain grinding machines have spindle speeds which are rheostat controlled, and infinitely variable from 40 to 144 and from 20 to 72 rpm respectively.

Lithium-atmosphere forge furnace provides protection from scaling up to 2400 F during heating of steel.

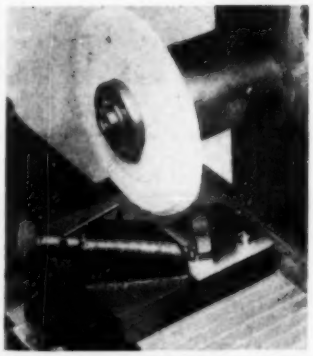
Contouring measuring machine provides record of results. Blades, cams, dies, and odd shapes are checked in a matter of a few minutes.

vides a mechanical advantage of 13.2 to 1.) The spindle of the lathe is run at 377 rpm. As the tool advances pins in the first pulley activate a switch, ringing a signal bell at each 0.2-in. increment of the tool travel. A mechanical counter, installed on the left of the headstock, records the number of spindle revolutions. These measuring devices facilitate accurate determination of the amount of metal removed. Standard test norm is 377 rpm at 81-lb tool pressure and 0.003 in. of feed per rev.

The solid-block toolholder is designed to hold the tool such that its edge is perpendicular to the direction of tool travel and the axis of the test piece. Toolbit is ¾-in. square high-speed steel. Angles on the tool are are 12° for rake and side clearance.

Powered by a 5-hp motor and providing 16 spindle speeds ranging from 24 to 1000 rpm, the lathe has a 16½-in. swing and is 30 in. between centers. The spindle accommodates bars up to 1.5 in. in dia.

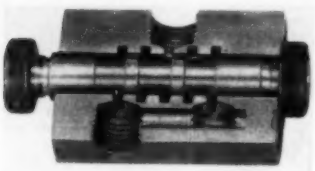
The Monarch Machine Tool Co., Sidney, Ohio.



Fixture Facilitates Sharpening Of Bokum Single-Point Boring Tools

The Bokum resharpening fixture, AB-1 consists of a rectangular base which is placed on a magnetic bed at right angles to the wheel and is expressly for all Bokum standard and extra-long tools, styles A and B from No. 00000 to No. 3. A diamond wheel dresser in one corner of the fixture serves as a guide in setting the wheel for most efficient performance.

Bokum Tool Co., Detroit 21, Mich.



Spool-Type Air Valve Controls Cylinder to Within 0.001 In.

The Hi-Cyclic Air Valve is said to control the stroke of an air cylinder within 0.001 in.; stop and return the stroke at any point without overtravel; control the speed of stroke in either direction; reciprocate mechanically or electrically; control the pressure in both ends of the cylinder; and effect a saving in air. The unit is a spool-type valve employing a stainless-steel piston with the valve body constructed of bronze bar stock. The piston is fit to 0.0002 in. and no packings or seals of any type are used.

Intake air flows to both ends of the piston through dual pressure ports, equalizing the pressure on the piston and providing balanced operation. The valve operates on airline pressure as low as 1 psi or as high as can be delivered to it. However, the normal passage of air passing the closed lens, which is less than two liters per min at 100 psi, in-

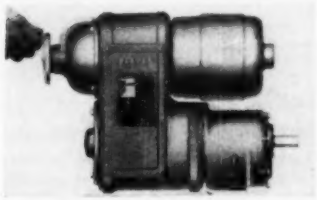
Atlas 15-In. Drillpress Offered in Floor or Bench Models

A floating drive with six-splined spindle and steel drive sleeve supported by two ball bearings are built into the Atlas 15-in. drillpresses. The units are available in high- and slow-speed models with choice of full-tilting or production oil table, Jacobs chuck or No. 1 or No. 2 Morse-taper spindle. The line includes 15-in. floor or bench models, production base and two-, three-, or four-spindle drills. The slow-speed bench model drills to 15-in. centers and provides nine speeds ranging from 400 to 4400 rpm, four-in. spindle travel, 12-in. maximum table to chuck, 16-in. maximum base to chuck, 10 x 10-in. table, and operates from 1/3- or 1/2-hp 1725-rpm motor. Units are equipped with ground steel quills.

Atlas Press Co., North Pitcher St., Kalamazoo, Mich.

creases in proportion to the increased pressure. This may be objectionable on some holding operations at pressures over 150 psi. The Model B basic valve is capable of 2500 cycles per min. Models range in size from ⅛ to 1 in. standard U.S. pipe size ports.

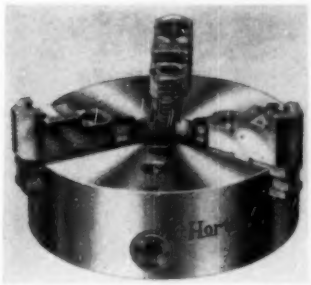
The Beckett-Harcum Co., Wayne Road, Wilmington, Ohio



Reeves Motodrive Put Out In Smaller, More Compact Model

These units combine motor, speed-varying mechanism, and reduction gears in one package. Hp sizes are ¼, 1/3, ½, and ¾. Ratios of stepless speed variation within 10:1 are available for each size. The "1000 Series" of Motodrive are small as 9⅝ in. in horizontal position and 16⅞ in. in vertical position. A total of 24 different assembly combinations for vertical or horizontal floor mounting or horizontal wall mounting are available for each hp rating.

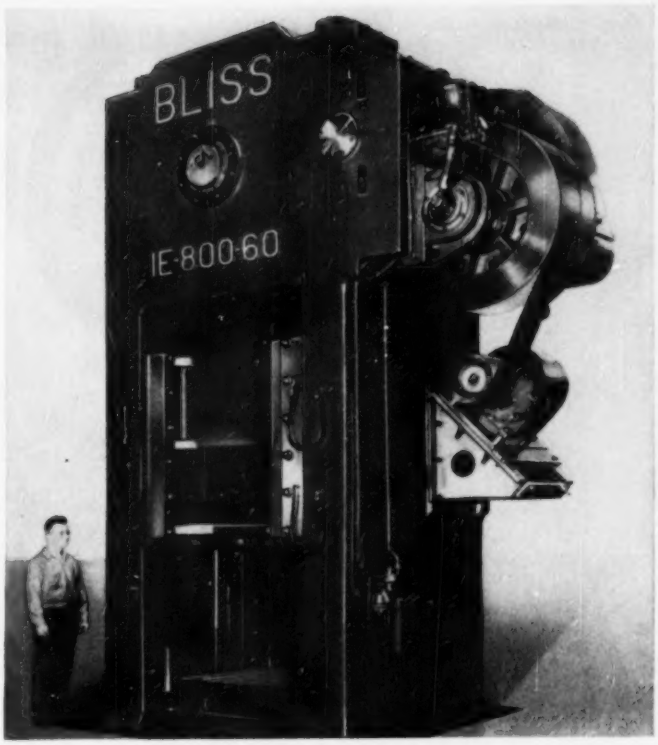
Reeves Pulley Co., Columbus, Ind.



Chuck Life Lengthened By Flame-Hardened Jaw Ways

Jaw ways of the Horton S line of lathe chucks are said to have been flame hardened without affecting the accuracy of the chuck body. The hardened ways are expected to prolong the chuck's life, initial accuracy, and gripping power. The chucks have hardened-and-ground replaceable pinion bushings, grease fittings, and wider top jaws of American standard design.

E. Horton & Son Co., Windsor Lock, Conn.



Reduced Headroom, Box Crown Built Into Large Presses

The main drive unit of these inclosed one-point presses has been lowered and the clutch and flywheel assemblies are outside the crown, reducing the required headroom for the unit. The crown, a long deep box structure, extends below the main gears, giving a rigid connection between the front and rear members. The fully inclosed box slide has a power elevating unit consisting of a worm-driven barrel connection. The slide is completely guided by long gibbing throughout all positions of stroke and adjustment. Flat gibbing is used on the pressure side of the slide and adjustable 45° gibs are used on the other side.

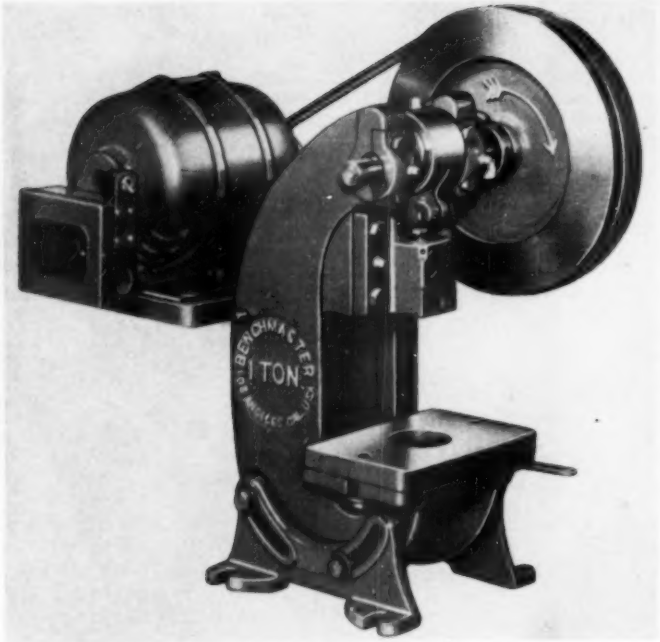
The main drive is fully eccentric and has a twin drive for balance loading. The main shaft rotates in the crown bearings and does not carry torsional load. A cascade oil lubricating system is used throughout except for the gib ways and roller bearings which are grease-lubricated. These presses are available in 500-ton capacities and larger and are equipped with Meehanite castings throughout. Crown panels are individual box sections.

E. W. Bliss Co., Toledo 7, Ohio

Friction Reduced by Micro Ball Bearing

The anti-friction micro ball bearing measures ¼ in. OD by 3/32 in. wide and has a bore diameter of 5/64 in., both diameters being held to tolerances plus zero, minus 0.0002 in. from the nominal. It is said to reduce friction by 1/3 compared to the next larger size.

New Hampshire Ball Bearings, Inc., Peterborough, N.H.



Belt-Tension Stop Added To Benchmaster 1-Ton Press

A motor unit equipped with a belt-tension stop on the Benchmaster midget press takes the weight load of both motor and bracket off the V-belt, increasing the life of the motor and flywheel bearings. The entire motor-mount assembly has been relocated, lowering the center of gravity of the press. The clutch mechanism and linkage have been improved and easier lubrication is afforded by addition of pressure-lubrication fittings at all wear points. Two hold-down slots, added to the bed for fastening the bolster plate, permits the use of standard dies and results in more open height. More open height results.

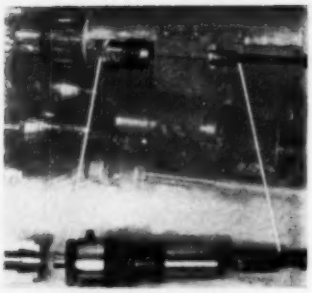
Benchmaster Mfg. Co., 2952 W. Pico Blvd., Los Angeles 6, Calif.

Automatic Screw Release Applied To Machinists' Vises, C Clamps

A semi-automatic-action clutch feature has been applied to machinists' vises and C clamps, and is said to permit practically instantaneous closing and opening of the clamp or vise. A spring-backed finger button acts as a release for the clutch, which is normally engaged with the thread of the screw. The clutch cannot be disengaged while pressure is on the work and the screw must be backed off slightly before the clutch can be disengaged.

Gordon Automatic C clamps in 4-, 6-, and 8-in. sizes are equipped with the new clutch. The machinists' vice, complete with lugs for mounting to machine tools and moving jaw, is V-grooved in both directions. Vise opening is 4½ in. and jaws are 3½ in. wide by 1 5/16 in. deep. The base is 11x13 over-all when closed. The clamps are priced at $3, $4.90, and $5.90 and the machinists' vise at $14.90. Two of the 8-in. clamps are said to be capable of lifting 2-ton castings.

Lockrey-Fater Corp., 401 Broadway, New York 13, N.Y.



Internal Forming Tool For Automatic Screw Machines

Series DB internal forming tool facilitates production operations on fully-automatic machines on jobs formerly requiring secondary set-up. It is recommended for back counterboring, thread-relieving, grind relieving, back chamfering, and ordinary recessing operations. DB tools can be used in any position and can be interchanged between different machines on which internal-forming operations are to be performed. Provisions have been made for accurate adjustment, for location and diameter of recess. The tools are available in three sizes with ranges from ⅜ to 2 in., 1 to 3 in., and from 2 to 4 in.

The Maxwell Co., 590 Broadway, Bedford, Ohio

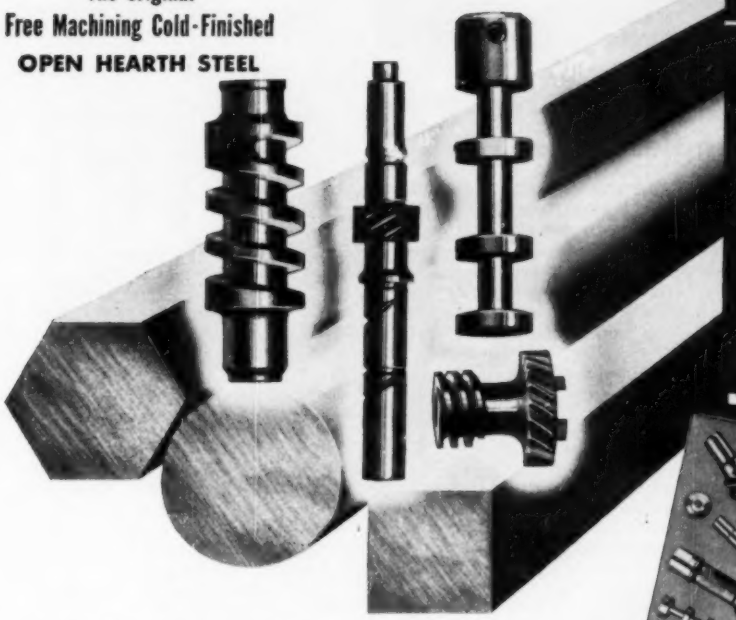
Portable-Equipment Floor Lock Provides Instant Releasing Action

A leaf treadle on the Rapids-Standard floor lock for portable elevators, conveyors, and floor trucks provides instant positive locking and release action. Rough-top belting on the floor plate is said to insure a non-marring, sure grip on all types of surfaces. Constructed of steel and arc welded unit come in three models, varying in weight from 2¾ to 6 lb and extended heights from 4 13/16 to 7¾ in.

The Rapids-Standard Co., Inc., Grand Rapids 2, Mich.

You can make them better with COLD-FINISHED J&L JALCASE

The original
Free Machining Cold-Finished
OPEN HEARTH STEEL

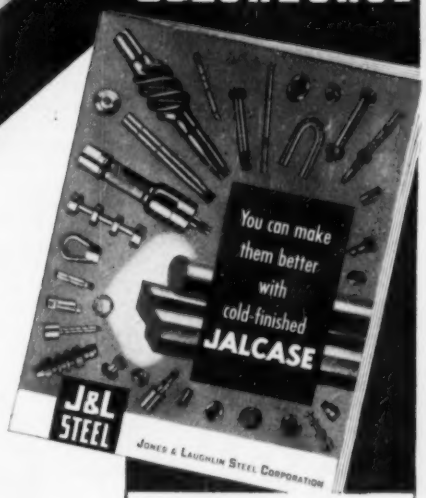


J&L STEEL

IF YOU WANT GOOD

. . . machinability
. . . heat treating properties
. . . high cold-drawn physical properties

SAY J&L JALCASE



★ **Available in a range of grades to suit a wide variety of applications.**

★ **Supplied as cold-drawn or cold-drawn-with-metallurgical-processing, which includes special tempering.**

Typical Jalcase analyses are found in the A.I.S.I. 1100 series. The usual manganese content is 1.00% to 1.65%. J&L, as the originator of these grades, can give you the benefit of years of know-how in the making of steel and the application of Jalcase to your particular requirements.

Some part you are now making can be made *better* from Jalcase with savings in money and time. Write us for a copy of "You Can Make Them Better With Cold-Finished Jalcase."

JALCASE STEEL IS QUALITY CONTROLLED FROM OUR OWN MINES THROUGH THE FINISHED PRODUCT.

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

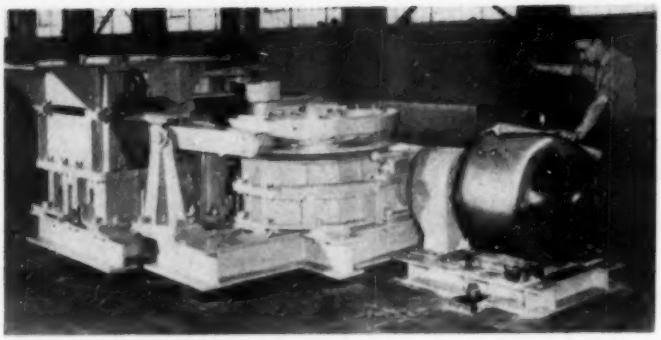
Jones & Laughlin Steel Corporation
402 Jones & Laughlin Building
Pittsburgh 30, Pennsylvania

Please send me a copy of your booklet, "You Can Make Them Better With Cold-Finished Jalcase."

NAME_____

COMPANY_____

ADDRESS_____

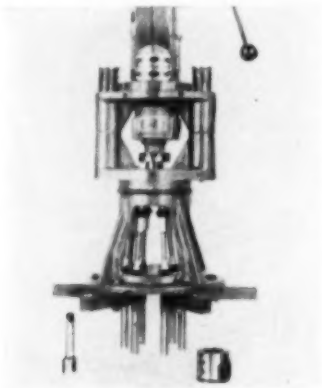


Bethlehem Bar-Bending Machine Gages Angles, Handles 1¼-In. Bars

Straight steel bars are bent into accurately angled zig-zag shapes for use as continuous web members on this bar-bending machine. Bars of any desired length can be fed straight into the machine and are bent over adjustable dies by roller. The roller, manipulated by a gear and cam, is arranged so the bar can proceed through the dies without obstruction.

The machine will make 6 to 20 bends a minute according to the size of the bar which is being cold worked. Powered by an adjustable-speed electric motor, the machine is operated by a pushbutton control with a limit switch to stop it for each bend. Capacity is 1¼-in. dia bar.

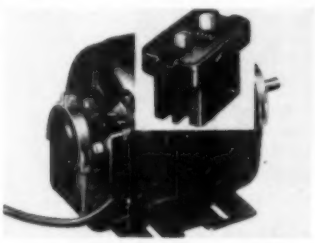
Bethlehem Steel Co., Bethlehem, Pa.



Multiple-Drill Unit Provides Infinite Number of Patterns

The Thriftmaster drilling and tapping unit is composed of a standard multiple-spindle adjustable drillhead and a standard Dorman automatic reverse-tapping attachment. It is adaptable to any drillpress and will drill or tap an infinite number of patterns. With taps inserted in chucks, the unit will tap multiple groups of holes on the downward stroke and automatically reverse on the upward stroke of the drillpress spindle. In normal operation spindles rotate in a righthand direction for drilling operations. Standard models are available with 2 to 10 spindles, adjustable from ½-in. minimum centers within a 10⅜-in. dia circle. The capacity for drills or taps is up to ⅜-in. dia in cast iron depending upon centers.

Thriftmaster Products Corp., Div. of Thompson Industries, Inc., 10 North Plum St., Lancaster, Pa.



Manual Motor-Starting Switch Incorporates Over-Heat Protector

The Klixon C9150 switch starts and stops motors, protects them from over-heating and burning out, and eliminates centrifugal switches. The switch incorporates two sets of normally opened contacts and a Klixon manual reset protector. A special thermal disk provides positive overheat protection, preventing the motor from burning out under dangerous overloads or stalled-rotor conditions. When the overload is cleared or the motor cools to safe operating temperature, the motor is started by pushing the start button. The unit is for application on motors from 1/12 to ½ hp, and can be made to fit into the motor end bell replacing existing terminal box cover.

Spencer Thermostat Div., Metals & Controls Corp., Attleboro, Mass.

Portable Stock Carrier Has Removable Sides, Ends

These carriers are designed with removable sides and ends and are of all-welded construction. They are built in 20 different stock sizes to suit a wide variety of material-handling problems. The units are made of seamless square tubing.

Rack Engineering Co., 925 Liberty Ave., Pittsburgh 22, Pa.

Temperature-Indicating Pellets Range From 113 to 2500 F

Beginning with 113 F, Tempil pellets are available in 12½° steps to 400 F, in 50° steps from 400 to 2000 F, and in 100° steps from 2000 to 2500 F. Tempilstiks, the crayon form of temperature indicator, are available in corresponding intervals from 113 to 2000 F, and Tempilaq, the paint form of temperature indicator, is produced in similar steps from 113 to 1600 F.

Tempil Corp., 132 West 22nd St., New York 11, N.Y.

CUTS GEARS FASTER

It cuts all gear teeth at the same time

LOWER TOOL UPKEEP

You sharpen all tools at once on a simple surface grinder

LESS IDLE TIME

Less total down time "per gear" for tool changes

LOWER INITIAL COST

One machine does the work of 6 or 8

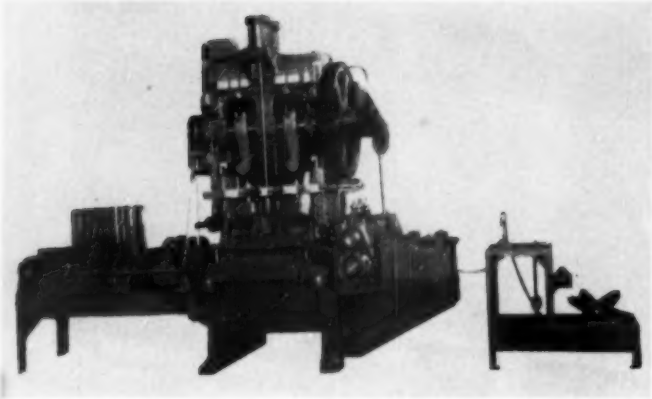
4 reasons why a SHEAR-SPEED can cut your gear costs

The Shear-Speed is *not a single purpose machine.* It can be used to cut costs on:

1. Spur gears or splines in either mass production or job lots.
2. Either internal or external gears.
3. Sprockets, ratchet wheels, free wheeling clutches, toothed clutches and other miscellaneous shapes, with *regular or irregular tooth spacing.*

COMPLETE — from blank to finished gear — EQUIPMENT

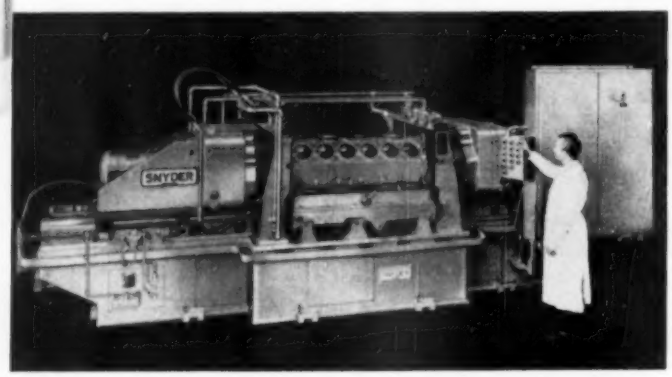
MICHIGAN TOOL COMPANY 7171 E. McNichols Road Detroit 12, U.S.A.



Double-Crank Gap Press For Production of Radiator Fins

This assembly-line setup includes a Cleveland 40G-36 double-crank gap press, uncoiler, roll feed, and stacker used in the production of radiator fins. The press is single-geared and equipped with a single-station electrically controlled drum air-friction clutch. Two strips of material (from 2¼ to 3½ in. width and from 21 to 35 in. in length) are pulled through the bending and corrugating rolls by the automatic roll feed and are then passed through the feed rolls into the press where they are punched and sheared to length. Rotating brushes automatically deliver the sheared material to the stacker, where they are stacked from the bottom up into two separate piles by an elevator which raises the stack to permit the series of fingers to position the next finished pieces. Stacks can be removed from the stacker without disturbing the operation of the press. Stroke of the slide is 1½ in. and the adjustment, 3 in. The face of the slide is 22x32 in., the area of the bed 22x44 in., capacity is 60 tons, and the unit is capable of 45 to 90 strokes per min.

The Cleveland Punch and Shear Works Co., Cleveland 14, Ohio

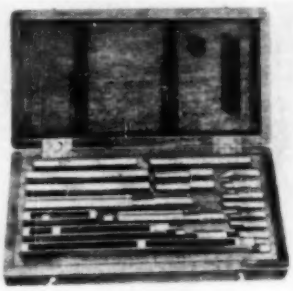


TWO-WAY HORIZONTAL line-index machine is equipped with two Snyder standard hydraulic slide units which carry multiple-spindle heads and is said to permit greater accuracy in drilling, reaming, and tapping holes in large aluminum-alloy crank cases. The tapping unit for the flywheel end of the part has 25 leadscrew spindles, and that for the opposite end is equipped with an 11-leadscrew spindle head. The machine drills, reams, and taps a total of 53 holes in the workpiece in three minutes.—*Snyder Tool & Engineering Co., Detroit, Mich.*

Tapered Reamer Removes Burrs, Improves Fits, Cleans Holes

Suitable for either hand or machine use, Tru-Reem tapered reamers will remove burrs, improve fits, enlarge or clean holes from 1/64 to 1/16 in. diameter. It is five sided and can be used on metal, wood, glass, or plastic. The tool is specially heat-treated to provide a hard cutting edge and tough core.

Woodruff & Stokes, Quincy 69, Mass.



Accessory Set Increases Application of Gage Blocks

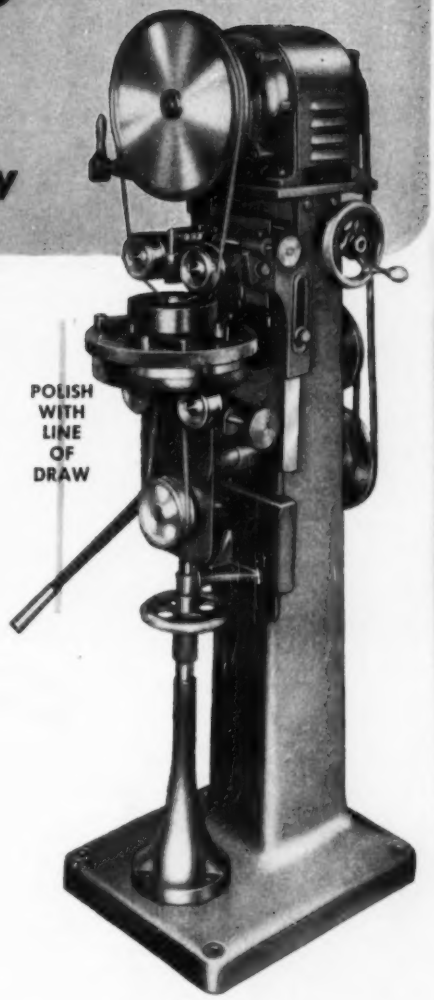
The Jansson accessory set is said to make possible a variety of additional applications for gage blocks, without the necessity of investing in numerous individual reference gages. It includes jaws, staightedges, adjustable holders in various sizes, a center point, and scriber. The jaws, used for assembling temporary limit gages for external and internal measurement, are furnished in six sizes with over-all lengths of 1⅝, 1¾, 2, and 2⅞ in. in solid design and 5⅛ and 6 in. in I-beam design. Two four-blade straightedges are included, one measuring ½x3¼ in., the other 39/64 x5⅛ in. Three adjustable holders are furnished with openings measuring 2¼, 5 and 8 29/32 in. The set is designed for application with all makes of precision gage blocks, and the complete unit sells for $210.00.

Jansson Gage Co., 19208 Glendale Ave., Detroit 23, Mich.

HARTFORD *Special*

DIE POLISHING MACHINE

pays for itself . . . quickly



saves time

Length of time required to polish dies with this machine can be computed in seconds or minutes. Endless abrasive belt is driven at 5,000 lineal feet per minute. Compare the speed of this motorized machine with time-consuming hand lapping or other polishing methods!

increases die life

The inner surface of the die need not be materially reduced. Dies can be held to size and repolished more often without reworking. Operation of the machine is so easy that dies can be polished quickly before any grooving or pitting appears. Accommodates almost any style of die, such as dies used in drawing rods, bars and tubing, as well as deep drawing dies.

finer finish

This abrasive belt method polishes dies parallel with the line of draw of work through the die. A finer mirror-like finish is imparted to the die which results in a better and finer finish to the work. Machine is adjustable to prevent bell mouthing of the discharge side of the die if necessary.

cuts cost

Since the Hartford Special Die Polishing Machine cuts polishing time to a fraction of former methods, increases the number of times dies can be repolished without reworking and increases the overall efficiency of the dies, its economy is apparent. Write now for full details on this modern method of die polishing.

HARTFORD *Special*

. . . the standard for special machinery

THE HARTFORD SPECIAL MACHINERY CO.
287 Homestead Ave., Hartford 5, Conn.

Please send me free Bulletin PM 100 describing your Die Polishing Machine.

Name _____ Pos. _____

Company _____

Address _____

City _____ Zone _____ State _____

Hand Lapping Machine Adaptable For Flat or Cylindrical Work

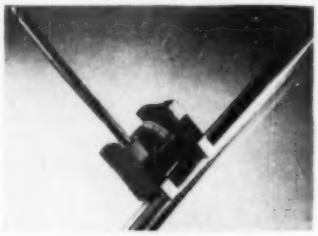
Lapping plates for this machine are 24 in. in dia and are furnished either plain for cylindrical work or grooved for flat work. Constructed of close-grain cast iron, they are heat-treated to prevent distortion from seasonal changes and are precision ground. The machine is 37½ in. in height and weighs approximately 600 lb. Speed and capacity are suited for rapid processing in small-lot manufacture as well as for toolroom requirements. It is particularly well adapted for finishing plug gages, mold details, fuel-pump housings, valve fittings, and other work requiring precision finishes or true contact services.

The Taft-Peirce Mfg. Co., Woonsocket, R.I.

Electric-Cord Reel Sports External Trigger Lock

Of heavy-duty construction with oversized bearings and shaft, the Model SW-25 electric-cord reel incorporates a long opening on the cable outlet which is equipped with a roller at each end and heavy-side beading designed to increase cable life. It is also equipped with an external trigger lock and swivel mounting. A 30-in. plug-in lead is furnished, as well as a motor spring.

Aero-Motive Mfg. Co., 1803 Alcott St., Kalamazoo 24, Mich.



Magnetic Base Applies to Round or Flat Surfaces

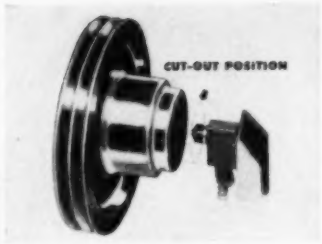
The "Minute Man" magnetic base is for quick application of dial-indicator gages and other tools, and may be used with either round or flat surfaces. The latter is effected by relocating the magnet barrel to allow for V slots on one side. Interchangeable brass shafts, 7/32 and 5/16 in. in diameter are provided for attachment of any dial-indicator gage or height gage. The unit has a 40- to 50-lb grip on all four sides.

The du Mont Corp., Greenfield, Mass.

Lightweight CO_2 Extinguisher Has Thumb Trigger Release

The Randolph 6-lb carbon-dioxide fire extinguisher, equipped with a thumb trigger release and self-aimed nozzle, can be operated with one hand. It has no valves or nozzles to adjust. It contains 6 lb of non-toxic, non-damaging carbon dioxide, and is adapted to smother flammable liquids and electrical fires.

Randolph Laboratories, 8 E. Kinzie St., Chicago 11, Ill.



Safety Cutout Protects Conveyors from Overload

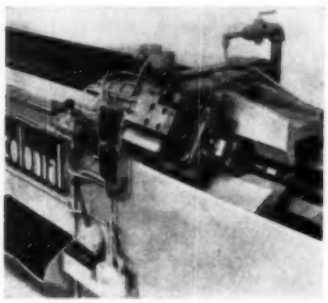
Anchor cutouts shut off electric motors instantly when conveyors or machines they are driving are overloaded, and reset them automatically, ready for immediate operation. The Junior model size O will handle capacities from 20 to 150 in.-lb and incorporates dust-tight, drip-proof case and lubrication for life.

Anchor Steel and Conveyor Co., 6906 Kingsley Ave., Dearborn, Mich.

Glass-Filament Tape Has 500-lb Tensile Strength

Scotch-brand filament tape No. 890 is made with glass and is reported to provide 500 lb of tensile strength per inch of width. Both shock resistance and tea. resistance are said to be extremely high. It is made in 72-yd lengths and in standard widths of ½, ¾, and 1 in. with other widths made to special order.

Minnesota Mining & Mfg. Co., St. Paul, Minn.

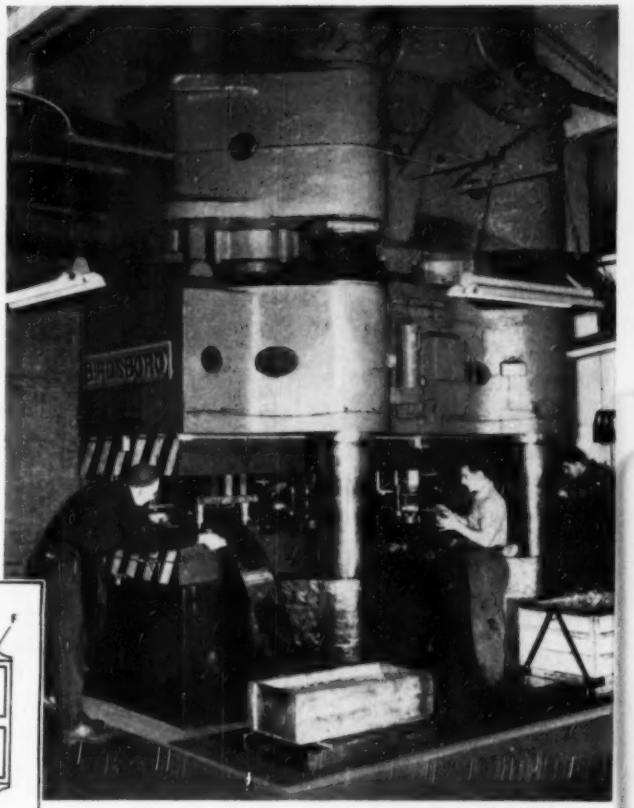


AUTOMATIC FIXTURE on Colonial universal horizontal machine broaches, simultaneously, three equally spaced slots, ¾×2 25/32×5/16 in., in transmission-synchronizer clutch hubs. Except for loading of parts, operation is completely automatic. A follow rest is provided for the top broach and the lower broaches are also supported through their entire travel. The machine is a 15-ton, 72-in.-stroke unit.—*Colonial Broach Co., Detroit, Mich.*

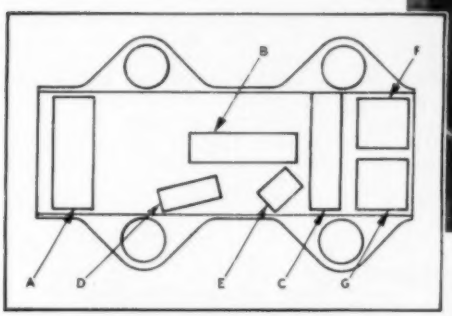
OPERATING 7 DIES ON ONE PRESS

means

Volume Production at Low Cost



2000 ton capacity Birdsboro Hydraulic Press with 60 sq. ft. of die space and 3 ft. daylight opening. Press is accessible from all 4 sides.



Typical diagram of 7-die layout used in producing appliance parts such as escutcheons, bezels, name plates and other decorative sections, radio panels, refrigerator compartment fronts, meter cases, automotive instrument panels and many others.

This Birdsboro Hydraulic Press is the economical answer to large scale production of many different stamped metal parts. Blanking, piercing, trimming and embossing are some of the operations that can be performed simultaneously—eliminating the need for individual presses for each operation, and saving handling of parts, resulting in lower labor costs.

Through accurate operating controls, slow platen movement is obtained for setting up dies and trying out new work. Pressure is built up slowly and sensitively. Designed for 3 man operation, the press is equipped with necessary safety features which protect both operator and equipment.

The advanced design of this press typifies the skill and experience of Birdsboro engineers who are always ready to go to work for you on any press problem. Take advantage of this engineering service, now.

AGENTS IN:

Boston, Massachusetts — Chicago, Illinois — Cincinnati, Ohio — Detroit, Michigan — Kansas City, Missouri — Los Angeles, California — Oklahoma City, Oklahoma — Pittsburgh, Pennsylvania—St. Louis, Missouri—Tulsa, Oklahoma.

Birdsboro Steel Foundry & Machine Co. • Birdsboro, Pa.

BIRDSBORO
HYDRAULIC PRESSES

DESIGNERS and BUILDERS OF:

HP-2-50 Hydraulic Presses • Steel Mill Machinery • Rolls • Special Machinery • Crushing Machinery • Steel Castings

Lightweight 7-in. Sander for Intermittent Touch-Up Work

The Junior sander is recommended for light sanding, metal-finishing, touch-up body work, removing rust, and wood surfacing. The tool weighs only 8 lb, has a cast-aluminum housing and heat-treated gears, and grease-sealed ball bearings throughout. The no-load spindle speed is 3500 rpm. It operates on ac or dc power and is available for 115 or 200 v.

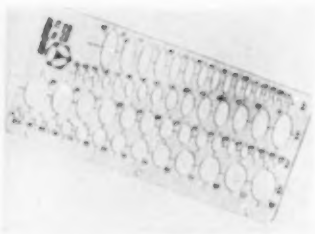
The Black & Decker Mfg. Co., Towson 4, Md.

Screw Machine Parts Marked During Machine Cycle

Automatic roll maker, which permits die marking of screw machine parts during the machine cycle, eliminates the need for separate setups for marking, and reduces both handling time and scraps. The tool is suitable for light and heavy work on automatic and hand-operated screw machines and bench and turret lathes. It is said to eliminate scoring or dragging on parts after marking and leaves no double impressions.

To order dies for this marker it is necessary to supply only the print of the part to be marked indicating chucked end of part, information on height, length, and depth of lettering desired, position of marker on screw machine, and direction of spindle rotation.

New Method Steel Stamps, Inc., 147 Jos. Campau, Detroit 7, Mich.



Ellipse Master Provides 60 Ellipses from ¼ to 1⅜ In.

The No. 78 Ellipse Master has ellipses in projections of 20, 30, 40, and 50 deg. Sixty ellipses are arranged in sizes from ¼ to 1⅜ in. in small increments grouped to allow a wide range of sizes yet maintain a handy working-size templet. The Ellipse Master is made of 0.03 double-cured mathematical-quality plastic, printing of axes and sizes is on a matte surface to minimize wear. Size is 5x10 7/16 in. and price is $2.50.

Rapidesign Inc., P. O. Box 592, Glendale, Calif.

Bantam-Size Three-Way Valve Provides 10-cmf Air Capacity

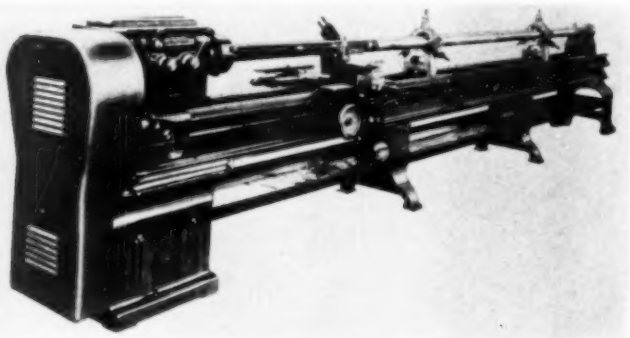
Designed primarily for use with Bantam air cylinders, the Bantam three-way valve is 2⅛x1⅝x1 3/16 in. and has an air capacity of 10 cfm at 100 lb airline pressure. It is built on a sliding-disk principle and houses a precision-lapped stainless-steel disk which slides on a bronze ring providing positive air-tight sealing.

A. Schrader's Son Div., Scovill Mfg. Co., Inc., 470 Vanderbilt Ave., Brooklyn 17, N.Y.

Precision Tool Drills, Taps in One Operation

The Subland combination drill-tap is for applications on through holes such as flanges. The drilling flutes, though smaller in diameter than the tap, are greater than the root diameter of the tap and are circle ground their entire length. As the drill completes the hole it serves as a pilot for the start of the tap. When the drill becomes dull and end sharpening is necessary, the tapping flutes are ground off an equal amount to retain drill clearance. Such sharpening can be repeated the entire length of the tool. The drill-tap is available in 16 standard sizes from 0.201 to 0.6875 drill with taps ¼ to ¾ in. NC and NF types.

Mohawk Tool Co., 21647 Dequindre Road, Hazel Park, Mich.



Bed Lengthened to 20 ft. On Sebastian 20-in. Lathes

Bed lengths for the Sebastian 20-in. geared-head lathe, both general purpose and gap types, are available up to 20 ft. The units are designed to handle a full range of work including long lightweight pieces, ordinarily machined on heavy-duty lathes. These lathes are equipped with 8-speed geared heads with Timken tapered bearings on headstock shafts, and Timken precision bearings on the spindle. The lathes come with reverse in apron for feeds; knob control handle for apron-length feed friction; 54 feed and thread changes; and accuracy of 0.0005 in.

American Steel Foundries, King Machine Tool Div., Cincinnati 29, Ohio

HENDEY
No. 2
GENERAL
PURPOSE
LATHE

Let's talk 'PRICE'

A good lathe costs money. The new Hendey No. 2 General Purpose Lathe is not an exception, but is an exceptional value. This lathe is an entirely new concept. It replaces the famous Hendey Cone Head Lathe, but retains all the facility—with a single lever belt shifter. It has eight speeds, but no expensive geared head. A unique feature eliminates belt pull on the spindle. There are 48 thread and feed changes, and graduations permit spindle indexing for cutting multiple threads. The Bed Ways, both Carriage and Tailstock, are hardened and precision ground. Here's a lot of lathe for the money—the price will please. Write today for details and catalog.

PRINCIPAL DIMENSIONS

Rated size	14"
Swing over ways	16 7/16"
Swing over cross slide	10 1/4"
Spindle bearings—Preloaded super-precision roller bearings	
Spindle nose	L-1 taper nose
Hole through spindle	1 1/2"
Range of spindle speeds	30 to 1142 R.P.M.
Carriage bearings on ways	21 1/2"
Width and length of cross slide	7"
Compound rest travel	4"
No. of thread and feed changes	48
Range of thread cutting	1 1/2 to 92

THE *hendey* MACHINE COMPANY

MAIN OFFICE & PLANT: TORRINGTON, CONN.

BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco

REPRESENTATIVES: Philadelphia, Cleveland, Pittsburgh

hendey

Lightweight Hand Truck of One-Piece Steel Construction

The frame of the No. A-106 hand truck is 13¾ in. wide and 45 in. high and is of one-piece all-welded steel construction. The truck can be equipped with wheels of solid rubber or 5-in. dia semi-pneumatic tires. A curb or step climber and solid nose can be added at a slight extra charge. The complete unit weighs 18 lb.

Sage Equipment Co., 30 Essex St., Buffalo 13, N.Y.

Kennametal Disk File Grinds Non-Ferrous Metals and Plastics

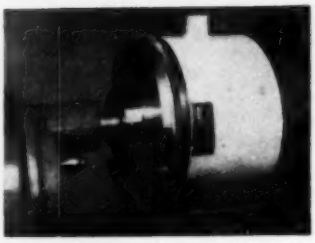
The expense involved in frequent replacement of abrasive wheels for such operations as snagging castings, cutting off flashings, and facing and squaring of surfaces on non-ferrous metals and plastics, is said to be eliminated by the Kennametal disk file. The files are made by brazing courses of triangular prisms of strong Kennametal (90.0 Rockwell A) to the face of a steel backer plate, forming a multiplicity of sharp cutting edges. The edges are so shaped, ground, and positioned as to provide a 30° negative axial rake, a 30° clearance angle, and a 10° negative radial rake. The material is removed in sizeable chips, eliminating abrasive dust. Disks are available in 6-, 8-, 10-, and 12-in. dia sizes, priced from $107 to $325. Recommended speeds, given by manufacturers for these disks, range from 5000 to 7000 sfm for harder materials and 8000 to 9000 sfm for soft or gummy materials.

Kennametal Inc., Latrobe, Pa.

Marking Tool Writes on Steel, Plastics, Other Metals

The Burgess Vibro-tool is equipped with a tantalum-carbide point and writes on steel or any other metal, plastic, wood, glass, or ceramic surfaces. Unit is for marking purchase dates, inventory, data, repair notations, serial numbers, and departmental classifications which will not wear off on virtually any material. A cool-running vibrator motor permits use for long periods of time without heating up. The Vibro-tool, complete with tantalum carbide point, retails for $7.50.

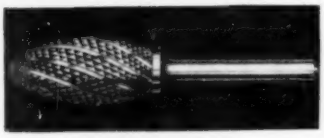
Handicraft Div., Burgess Battery Co., Lake Zurich, Ill.



Levers, Dogs, in Air Cylinder Increase Gripping Power

The Erickson air cylinder uses the mechanical advantage of levers or dogs to give increased gripping power, and is reported to develop three or four times the drawbar force of a conventional air cylinder with the same piston area. The piston is of the donut design, permitting bar stock and work to pass through the unit. It has a movement of ⅛ in. in either direction, and may be used for either push or pull mechanisms.

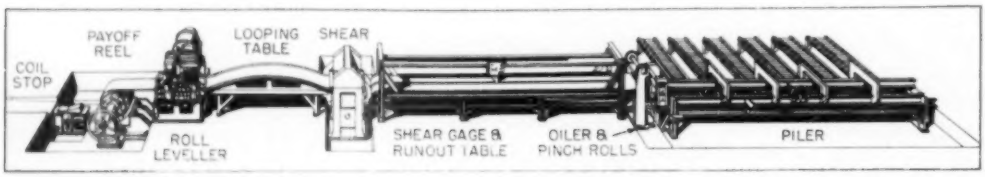
Erickson Tools Div., 2311 Hamilton Ave., Cleveland 14, Ohio



Flutes Deepened on Diamond-Cut Carbide Burs

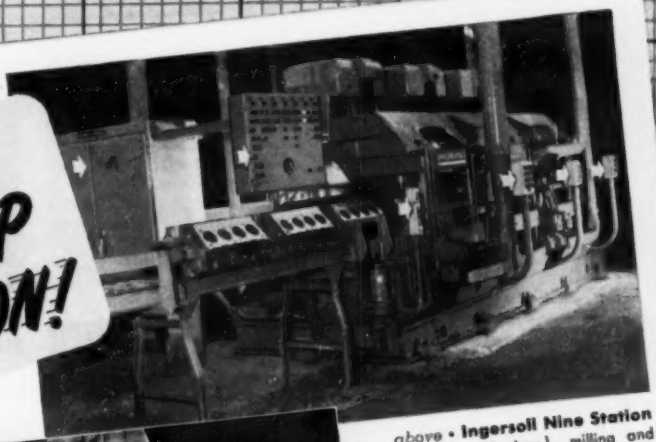
To provide the operator with better control, especially in nose cutting on tough steels, flutes have been deepened at special intervals on the Di-Burs diamond-cut carbide burs. The tools are master ground from forms on special machines to prevent formation of minute flats. Flutes are ground in solid blanks from the shank end to eliminate the "hop" or "jump" so damaging to carbide.

Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford 1, Conn.



BLISS SHEAR LINE, for moderate production in steel and copper mills, warehouses, and fabricating plants, flattens and cuts coil stock to any length at approximately 300 ft per min. The upcut shear has a solid one-piece frame and is operated through an air clutch with built-in flywheel and integral brake, actuated by a four-way solenoid valve. Turn-over speed of the shear is 60 cuts per min.—*E. W. Bliss Co., Detroit 2, Mich.*

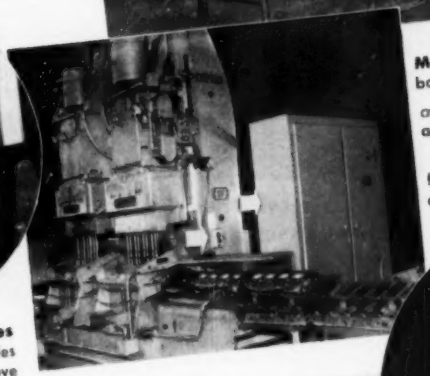
DESIGN LEADERSHIP IN ACTION!



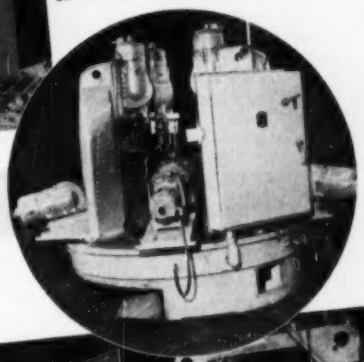
above • **Ingersoll Nine Station Machine** (partial view), milling and boring cylinder blocks.

at left • **Foote-Burt Machine,** reaming and facing valve guides in cylinder heads.

below • **Kingsbury Machine,** chamfering and forming ball seat, and drilling oil hole on rocker arms.



above • **Krueger-Barnes Machine,** drilling 12 smoke holes in piston oil ring groove



SQUARE D MOTOR CONTROL

operates every automatic machine tool in this New automotive engine plant

• These pictures show only a few of the tremendous battery of Square D controlled machine tools in one of the country's newest and most modern automotive engine plants.

There are sound reasons for selecting Square D. Unusual completeness of line satisfies virtually any AC or DC application requirement. Standardized components, each designed to perform a specific control function, are all physically proportioned to make up compact, attractive control panels. There is no wasted space—yet there is complete accessibility for speedy inspection and maintenance. Square D control is designed for machine tool service.

Write for Machine Tool Control Bulletin 207 describing Square D's complete line. Address Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.

Cincinnati Mill-Broach Machine, milling and broaching cylinder heads.

SQUARE D COMPANY

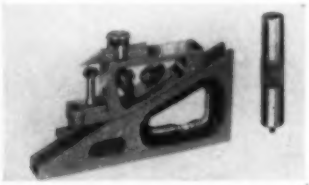
DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S. A., MEXICO CITY, D. F.

Rockwell Convection Pit Furnace Tempers, Normalizes to 1200 F.

The heating chamber of this electric recirculating air pit furnace is insulated with 4½-in. layer of refractory brick, backed up with 3½ in. of block insulation. The furnace bottom consists of 4½ in. of insulating refractory brick overlaid with 2½ in. of fire brick. This basket-loading unit, complete with thermocouple temperature controller, is available in capacities of 200, 300, 600, and 1500 lb of steel per hr. The unit is for drawing, tempering, and normalizing to 1200 F. The furnace is heated by a series of removable Nichrome electric heating coils completely surrounding the alloy-steel basket which rests on an alloy grid plate. The basket is 30 in. in diameter by 32 in. deep with solid 18-8 stainless-steel sides and cast-grid bottom overlaid with heavy mesh screen.

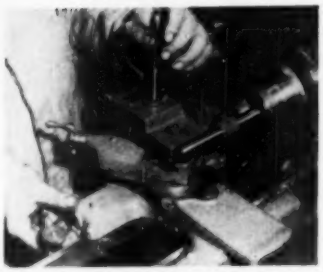
W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn.



Fine Adjustment, Versatility Combined in Precision Gage

The Starrett universal precision gage is for gage makers, inspectors, tool and diemakers, and machinists. A quick adjustment of the knurled thumbscrew sets the gage to the exact size required, either from a micrometer height gage, vernier caliper, or gage blocks. A clampnut locks the slide in place. Both thumbscrew and locknut are smaller than the gage thickness, permitting the gage to be used on its side without interference. A scribing attachment adapts the unit for surface or height gaging and an offset attachment is available for setting in narrow areas or working ⅛ in. below the base line. The 3-in. knurled extension provides an increased range of 9¼ in. Approximate width of the gage is 3¼ in., length 5¼ in., and capacity with both extensions, 10½ in. Capacity without extensions is 7 in.

The L. S. Starrett Co., Athol, Mass.



External, Internal Thread Chasing Facilitated by Lathe Attachment

The Meritool automatically retracks the lathe tool from work at any desired setting, simplifying chasing of precision threads. Small- or large-lot production can be done on any ordinary lathe with repeatable accuracy. The attachment can be mounted on any 9-to 14-in. capacity V-wayed lathe.

The Motch & Merryweather Machinery Co., 715 Penton Building, Cleveland 13, Ohio

Magnet-Hold Center Punch Simplifies Center Location

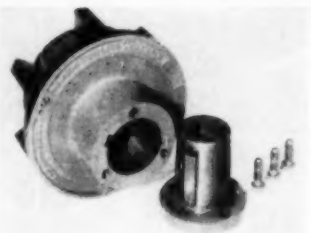
A fast, simple, and accurate method for locating centers in drilljigs, dies, molds, and fixtures has been developed in the Magnet-hold Perfect center punch. Intercepting lines are scribed with a height gage and used in the usual way. The punch has a powerful Alnico magnet which holds the bushing directly in center when the four sharp corners are lined up with the layout lines. Essentially the center is magnified to over ⅝-in. dia.

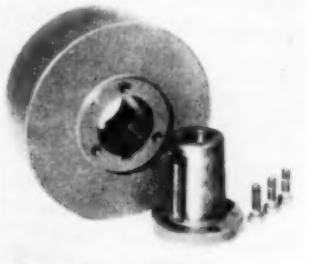
Magnet-Hold Perfect Center Punch Inc., 837 Central Park Ave., Yonkers 4, N.Y.

Granite Precision Parallels Made by Hand Lapping Process

Precision parallels are made of black granite (diabase) to a claimed overall tolerance of 0.00005 in. in a set, in sizes from ½x1x6 in. to 1x2x12 in. Larger sizes can be made up to 4x6x30 in. Original accuracy in manufacture is said to be maintained indefinitely because of hardness of the black granite. It also will not rust and does not burr when accidentally nicked.

Bahn Granite Surface Plate Co., 1149 Platt Circle, Dayton 7, Ohio





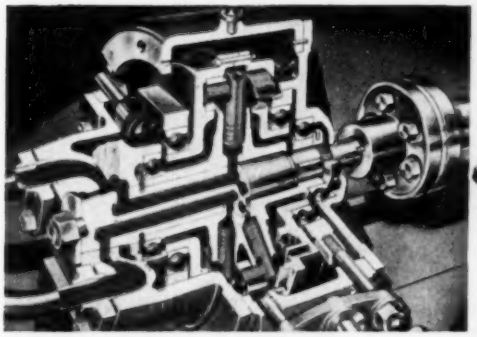
Rawson Clutch Coupling Has Taper Bushings

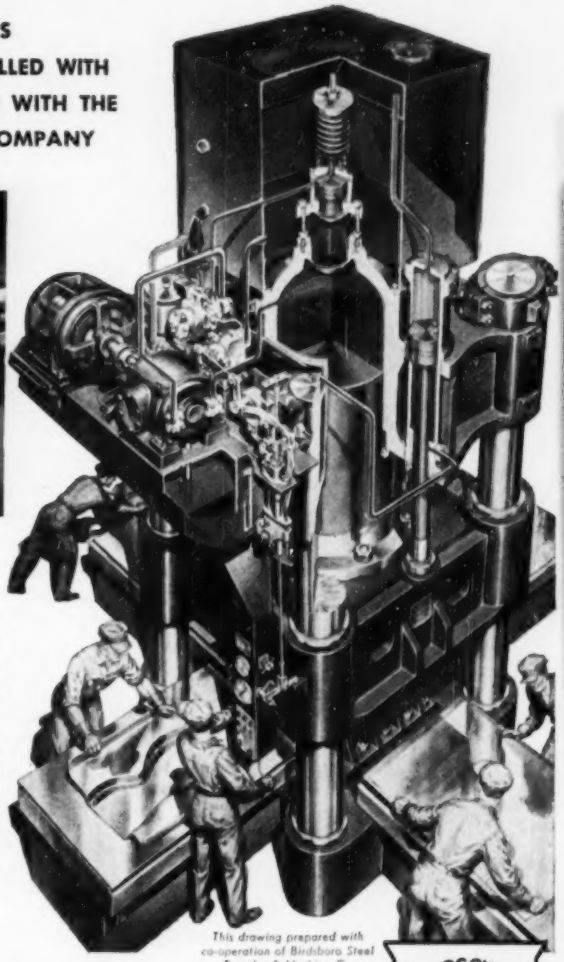
The Rawson clutch coupling is adjustable on the job for various hp requirements and can accommodate shafts from ¾ to 1¾ in. diameters with standard keys. The split-taper bushing wedges the tapered coupling hub tightly to the shaft showing a close fit. These units are ready for use with motors from 0.43 hp at 580 rpm to 25.7 hp at 1800 rpm.

Centric Clutch Co., 22-26 South Ave. West, Cranford, N. J.

First Choice for Hydraulic Machines!

MORE HYDRAULIC SYSTEMS IN INDUSTRIAL MACHINERY ARE FILLED WITH SOCONY-VACUUM PRODUCTS THAN WITH THE PRODUCTS OF ANY OTHER OIL COMPANY





This drawing prepared with co-operation of Birdsboro Steel Foundry & Machine Co.

HERE'S WHY...

Famous Gargoyle hydraulic fluids have clearly demonstrated their ability, in thousands of machines, to assure smoother, more continuous operation, extend periods between drains, reduce maintenance time and expense.

They are approved by major builders of hydraulic mechanisms, and are backed by the world's greatest lubrication knowledge and engineering service. Gargoyle hydraulic fluids are constantly being improved by Socony-Vacuum creative research.

Enjoy the cost-saving benefits of Correct Lubrication. Call in Socony-Vacuum today!

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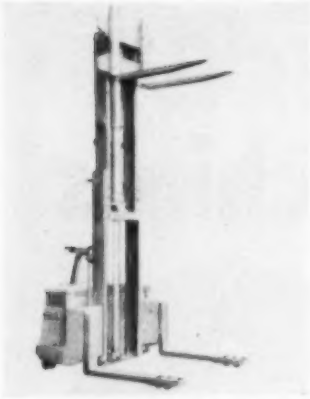
GARGOYLE Lubricants

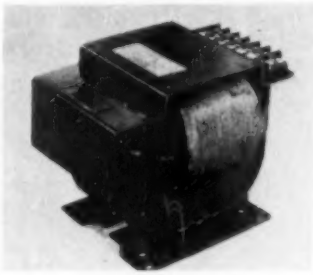
WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE



Walkie Fork Truck Lifts to 121-In. Height

This fork truck is available in 3000- and 4000-lb capacities in two models. One has an over-all height of 83 in. and a total lift of 121½ in. and the other an over-all height of 68 in., and a total lift of 91½ in. The truck travels at 2 mph under full load. Twelve-volt battery is standard, battery compartment accommodating cell sizes up to 19 plates.

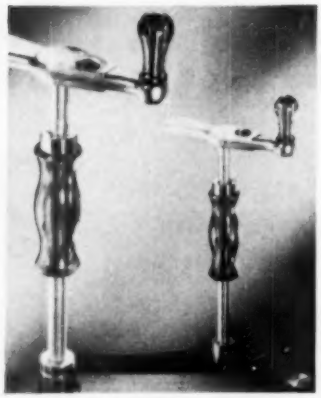
The Yale & Towne Mfg. Co., Philadelphia 15, Pa.



Compact Transformers for Machine-Tool Control

A grain-oriented magnetic-steel Hipersil core reduces size and weight and is said to improve performance of this machine-tool control transformer. It is particularly adapted to inductive low power factor loads of solenoids, relays, and contactors, making up machine-tool control equipment. Secondary voltage of these 60-cycle units remains above 90% of rated voltage up to a load current of 7 times normal at 20% load power factor. Circuit breaker protection is normally supplied on ratings of 0.3 kva and larger, while on ratings 0.15 kva and smaller, the block is mounted for customer's fuses. Seven sizes from 0.075 to 1.5 kva are available for 220-440 volts primary to 110 volts secondary at 60 cycles.

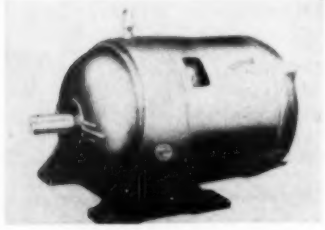
Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.



Multi-Purpose Speedratchet Fits Any ⅜-In. Drive Series

The Speedratchet may be used as a palm-grip ratchet T-handle, as ratchet and extension, as maximum-clearance speeder, or as a counterbalanced spinner. It fits any ⅜-in. drive series including extensions, drag links, universal joints, regular and Phillips screw drivers, sockets, and adapters. Hand grips are machined from extruded tenite and are said to withstand heavy impact without breakage.

Herbrand Div., the Bingham-Herbrand Corp., Fremont, Ohio



Helical-Gear Reduction Units Offer 700 to 7.5 Rpm Output

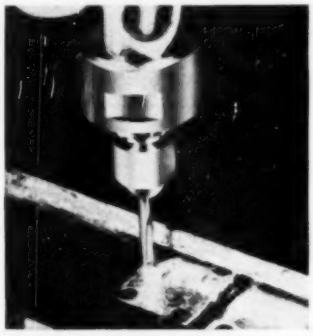
This gear motor, manufactured in 17 sizes, provides single-, double-, and triple-reduction units with output speeds from 780 down to 7.5 rpm. Horsepower ratings from 1 to 75 are available. The unit is equipped with hard helical gears and can be obtained for either ac or dc operation.

Foote Bros. Gear and Machine Corp., Chicago, Ill.

Dual-Load Balancing Hoist Neutralizes Workpiece Weight

The Dual-Load balancing hoist is constructed to operate on a 4- or 6-in. standard I-beam and neutralizes weight in any position within the balancing range. It swivels vertically from 0 to 17° and rotates 360°. The hoist is manufactured in balancing ranges of 36 and 42 in.

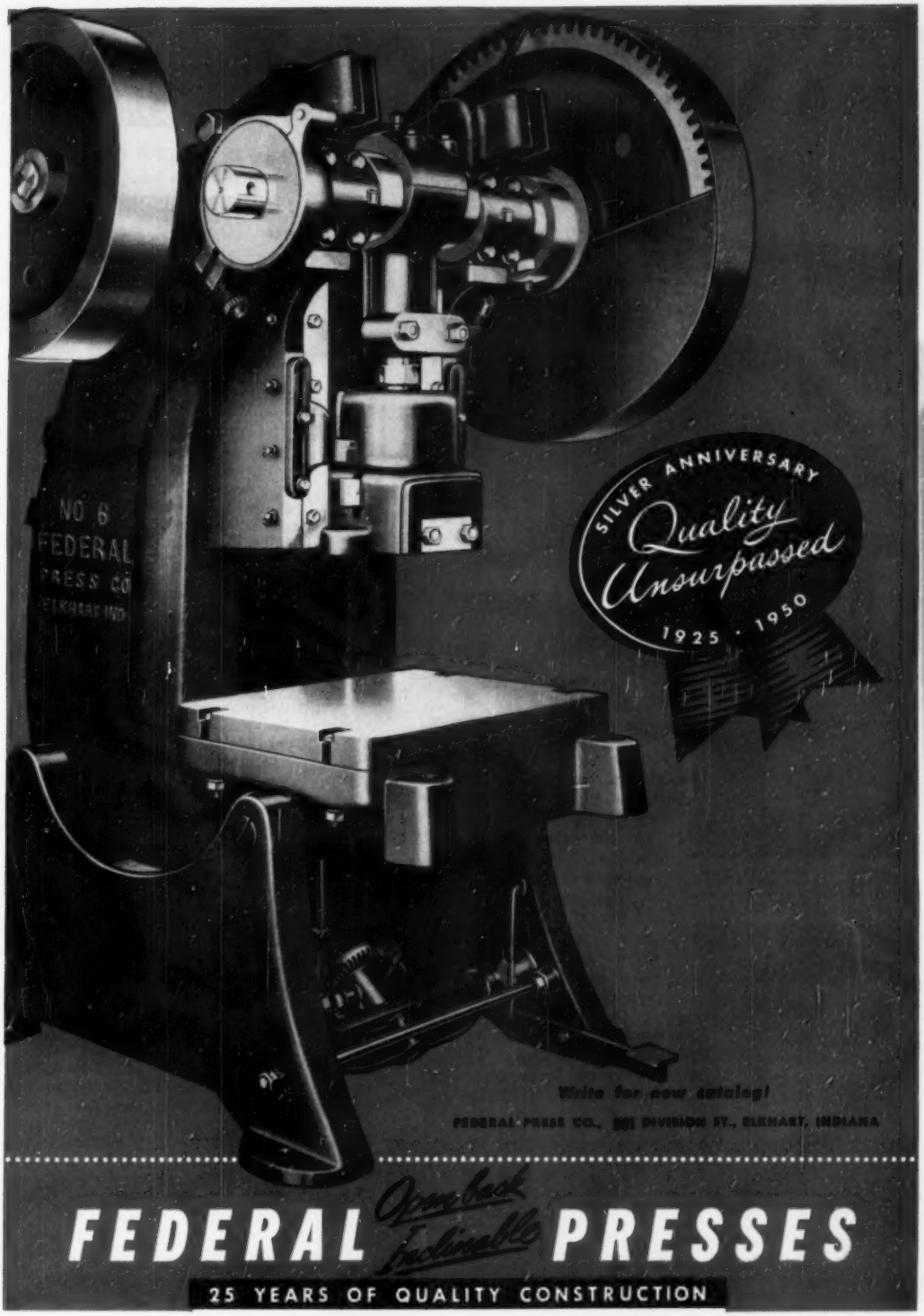
The Platz Co., Inc., 20433 Sherwood Ave., Detroit 34, Mich.



Carbon-Steel Taps Available With 260 Threads per In.

Between 2500 and 4000 threading operations per tap have been reported by the W-S small carbon-steel taps. They are available in standard or special sizes up to No. 2 (0.086 in.) and with up to 260 threads per inch. The cut thread and flutes are highly polished to reduce drag and fatigue. Radial chamfer and radial flute are said to produce high-strength cutting edges and extra chip clearance. They are reported to be accurate to within ±0.002 in. on pitch diameter. Taps having special pitch diameter or thread profile are available on special order.

Woodruff & Stokes Co., Quincy 69, Massachusetts.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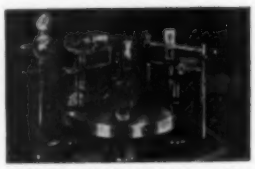
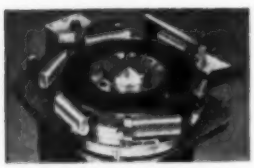
PRODUCTION MARKING MACHINES



MODEL 246—Tooled for marking aluminum condenser parts. Production speed 60 to 70 pieces per minute.



MODEL 286—Tooled for marking capacitors. The complete inscription is permanently *rolled in*, lasts as long as product itself.

Don't let obsolete marking methods or equipment slow down your operations when production efficiency is so important in meeting today's changing business conditions. The new Noblewest production marking machines, such as Model 157 (illustrated) have been developed especially to meet industry's demand for higher marking speeds and lowest cost per unit marked. Leading manufacturers in many fields are saving time and money every day with these superior marking machines. Whatever you make—in metal, plastic, hard rubber, etc.—chances are you too can mark it faster, better, at lower cost with Noblewest. There's no obligation to find out. Just write Noble & Westbrook Manufacturing Co., 17 Westbrook Street, East Hartford 8, Conn.

MARK IT BEST WITH NOBLEWEST

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

ROUND TABLE *Discussion*

TEN CENTS A CHANCE

Raffles are quite good, harmless fun and frequently serve a useful purpose by assisting good causes but they should not be conducted during working hours and the foreman who takes no steps to discourage such misconduct is obviously asking for trouble.

In a workshop, it is amazing how, by almost imperceptible degrees, discipline can slip and output fall just because someone in a controlling position fails to recognize the thin end of the wedge being applied. Having winked at the harmless raffle the foreman concerned need not be surprised to learn of a miniature football pool being set in motion and without doubt gambling has a greater attraction for most of the world's population than has honest work.

This particular form of lunacy can be stopped provided the executives concerned are intelligent enough and courageous enough to set the correct example. By disassociating themselves entirely from all forms of entertainment during working hours and by coming down, swift and heavy on all who would seek to encourage and indulge in them, the executive can put a stop to such a crazy waste of time without imposing too heavy a burden on themselves or the operatives.

Example, of course, on the part of the men who are responsible for shop control and discipline is what matters most. If an executive shows even a faint interest in any form of entertainment, however mild, during working hours he thereby renders immeasurably more difficult his task of keeping good discipline. There is a deal of difference between occasionally winking at a slight misdemeanor and of appearing to countenance it.

Many years ago apprentices in this country were officially forbidden to make tools for themselves during working hours. Executives knew that the lads did, in fact, make tools during working hours but so long as the boss did not see the tools being made no action was taken against the offenders. This attitude had the effect of reducing the nuisance to minimum proportions whereas recognition of the offense would soon have resulted in tools being made on working hours, for sale, much the

HERE'S A TOUGH MULTIPLE-OPERATION PROBLEM

PERFORMS 3 OPERATIONS PER CYCLE—
Shearing, Riveting and Straightening
ON FORGED STEEL PARTS
at 35 Cycles per Minute

Solved by Elmes!

For nearly a century, Elmes hydraulic specialists have been solving problems such as this one, brought to Elmes by a prominent manufacturer of farm implements. Each problem in turn has been met with the characteristic ingenuity that built the Elmes Press reputation for excellent performance.

Shearing, riveting and straightening forged steel work— *subject to variations in thickness*—on a single stroke of a press, call for proper application and accurate regulation of pressure. To meet these requirements, Elmes supplied the 100-ton Automatic Openside Press shown above—and turned several troublesome, costly procedures into one smooth, fast, profitable operation. This 3-way operation is being performed unfailingly at speeds up to 35 cycles per minute.

Why not put your pressing problems up to Elmes? Objective engineering, backed by many years of successful hydraulic experience, makes Elmes Presses right for each job. Our staff of specialists is at your service with suggestions, recommendations or cost estimates on existing press designs or new developments—without obligation on your part.

ELMES 100-TON AUTOMATIC OPENSIDE PRESS

Moving platen, 18" x 16". 3" stroke. High and low pressure pump provides rapid advance, slower pressing speed and rapid return. Photo-electric safety control stops platen immediately if obstruction breaks light beam at entrance to dies. Accessible, fast, flexible. Sizes and capacities for all service needs.

DO YOU HAVE THIS ELMES HYDRAULIC METAL-WORKING PRESS BULLETIN?

Covers single-action, double-action and triple-action presses; standard designs; special applications; automatic feeds. Your Elmes distributor can supply you, or request direct. Ask for Bulletin No. 1010B.

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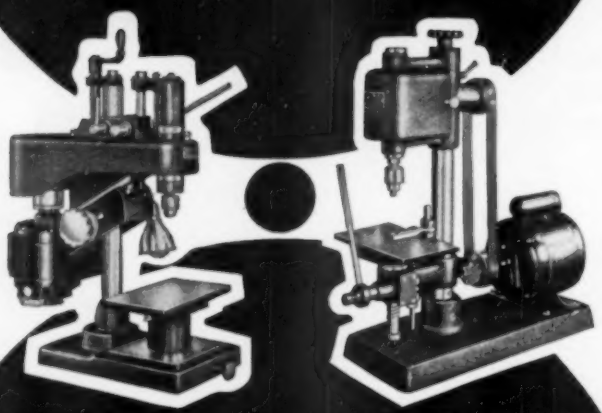
SMALL PRECISION HOLES
DRILLED ● TAPPED
AT LITTLE COST



Hamilton Varimatic Drilling Machine.

Hamilton Precision Tapping Machine.

The "Hamilton" line of four small hole, precision drills were developed for tool room use and built to the requisite tolerances. In use, they were found to be so brawny that they rapidly found their way into production.

During the years of their use on production work they have been proved to "stand up" under heavy production loads and to maintain their accuracy.

Eighty percent of the present sales of these machines are repeat orders.

The Hamilton Small Hole, Precision Tapper is the ideal companion tool to the "Hamilton" line of drills. It incorporates the same stamina and is built to the same tolerances.

Unsolicited letters from users are enthusiastic in appreciation of this machine's many exclusive features.

DESCRIPTIVE LITERATURE ON REQUEST

The time you spend in investigation of these machines will be paid for in production gains.

THE Hamilton TOOL COMPANY
SUPER SENSITIVE DRILLING MACHINES
TAPPING MACHINES · PORTELATORS
830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

same as cigarette lighters were made and sold on the quiet, during the war, in some of the loosely controlled shadow factories over here.

C. D. Mackinnon
Airdrie, Scotland

HOT POTATO

In cases of this kind the top men should forego all vacation plans and remain on the job when necessary. Some plants may have capable subordinates to carry on and in that case we can excuse the top man. However even then if the management thinks it would be safer and more expedient for the top man to be there, he should be there. It's just like the tradition of the sea. This may upset family vacation plans somewhat when the setup comes during school holidays and has to be cancelled till a later date.

The man who cannot keep his vacation schedule flexible enough to meet such a situation should not hold the job.

You have to look at this in a general way. Should a slip-up occur due to the absence of said top man and for lack of some knowledge or skill of his, the whole shop may feel the loss of some valuable contract that may be lost.

You never can tell because situations vary so much. I know an instance of an engineer with important research and experimenting under way, who would not postpone his summer vacation. When he returned he found the stockholders in session. They summoned him before them and he barely saved his job. After that he adjusted himself to his job, not the job to his plans. He is still with this firm years after and the lesson is a good one.

Some years ago, I was in charge of a toolroom where management asked us to draw slips from a hat for vacation periods. I drew the last week in August. One emergency after another held me until Xmas, as we were experimenting and won big contracts from nationally known firms. My delayed holiday paid in business and gained prestige for the firm and work with overtime in many cases for employees. I don't regret or miss that today. Now, on the other hand, I don't believe in dumping this work on some particular man just because he is good when you may have other capable men who can carry on. This is placing a penalty on a man for his skill. I have actually heard men in this spot curse themselves because they knew too much and got hooked. I know a tool and die maker very well who got hooked for a lost vaca-

NEW PATENTED STEEL BAR SAVES YOU MONEY 4 WAYS

PROVIDES 4 IN 1 IN-THE-BAR-QUALITIES

Here is a cold-finished carbon steel bar, produced by a patented LaSalle process, that possesses in-the-bar a unique combination of *all four* desired qualities . . . Strength . . . Machinability . . . Wearability . . . Minimum Warpage. STRESSPROOF is a high strength steel (twice as strong as ordinary cold-finished shafting) and is used without heat treating. It machines well, too—fully 50% better than heat-treated alloys of the same hardness. It possesses better wearability than many heat-treated carbon or alloy steels, and has been used successfully to replace case-carburized steels. Furthermore, because STRESSPROOF is stress relieved, warpage after machining is negligible, and straightening operations can be eliminated. Yet STRESSPROOF costs little more than ordinary cold-finished bars. It is also furnished ground and polished to close accuracies.

Stocked by Leading Steel Warehouses

LaSalle STRESSPROOF

Reg. U. S. Pat. Off.

SEVERELY COLD-WORKED FURNACE-TREATED STEEL BARS

SEND for FREE ENGINEERING BULLETIN

"New Economies in the Use of Steel Bars"

LaSalle Steel Co.
1416 150th Street
Hammond, Indiana

Please send me your STRESSPROOF Bulletin.

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tion. This fellow came through with a better idea that the firm accepted and voted money to make use of the idea. The affair embarrassed the man in charge to a considerable degree. He bided his time and in a matter of months contrived to let his top man out. So there you have the reaction to what goes on in the shop over these cases.

Henry Rasmussen
Niagara Falls, N. Y.

•

It is expected that a man will do all that he can to satisfy his superior officer, therefore when the Old Man asked Ed to put his best men on a specially important job and personally watch it through, stating that if it was done promptly and satisfactorily there were good prospects for more business. Certainly Ed should, so far as possible, do his best, even if it meant some sacrifice on his part to meet the Old Man's desire.

This particular job as presented bids fair to bring future business if done satisfactorily. Therefore all those concerned should be informed of this fact which would be an inducement to both foreman and workman to give their best to the job, thus showing a helpful and liberal spirit as well as each making his contribution to the welfare of the organization, as it is a well-recognized fact that the organization must prosper to enable it to do well by its employees.

Every individual has some personal desires which, from a selfish standpoint, they would carry out. But there is so much in this world that cannot be done without interference with others that it behooves us all to look at our problems in a liberal and co-operative view, insofar as our actions have an influence on others.

This particular hot potato should be thoroughly analyzed and understood in its far reaching effects by all concerned, and when that is done there will be need for some give and take, but in the end will be a satisfaction to all, as all concerned may feel that they have done their part.

The following case came to my notice: In a certain shop there was an order received to make one set of parts for a special machine, which required unusually accurate work. This amounted to several days work and was all done by one man who, when the job was finished, commenced his promised vacation and the parts were shipped to the purchaser.

Promptly when the parts were received it was discovered that only

let's get down to earth!

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one set had been ordered whereas there should have been four sets.

A telegram was sent to the machinist asking, if possible, that he come back to the shop as soon as he could to make the three sets of parts still lacking. The following morning the machinist reported back at the shop for work.

About one year later this young machinist was given the foremanship of the shop although he had only about five years' shop experience of which three had been spent in this shop. There he remained for the next ten as the foreman, until a better job was secured elsewhere.

Abel Blakeman
Watervliet, N. Y.

•

Ed has been handed a job that calls for giving up his planned vacation as well as cancelling vacations for some of his workers. Not a pleasant thought and not one that most of us like, or want to handle. Sure the boss got off easy. He'll get his vacation and let Ed do the job.

We can't help but wonder how long the boss knew that this job was coming up. Probably for several months or at least weeks. Generally speaking things do not just pop up overnight without some previously considered plans.

Most workers do come to work because it is necessary to work for a living. It is doubtful if many people work just for the love of working. But workers rae human beings—they don't expect to sell themselves body and soul to the employer. They feel they have some rights. The reason workers join unions is because the industrial world has taken them for a ride so many times that they have found proper protection only in unions. Most workers don't actually like unions or like belonging to them, but in order to secure any rights for themselves it is a necessary evil.

Why, oh why, won't the industrial management groups wake up and see the error of their ways? Maybe it is because they are too close to the problems. All they need to do is to act as human beings and act as grownups rather than overgrown bullies.

Now, if Ed is satisfied in his own mind that the need for all this rush is justified, it is not too much of a problem to sell his boys. But the implciation is there that there is doubt about the efficiency of top management and this means that Ed will not do a good job. He can not sell his men, he will probably get the job done but it will not be efficient operation and it will be costly to the company and the workers will

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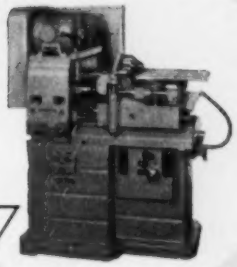

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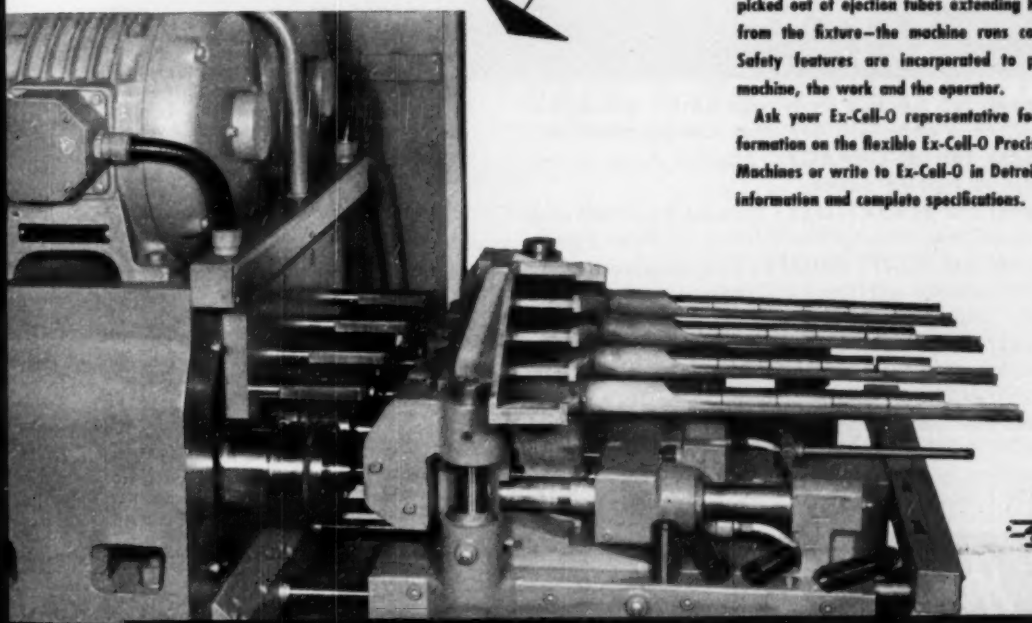
Standard Ex-Cell-O Precision Boring Machines can be tooled either as simple, general-purpose machines or as automatic, high production, single-purpose machines. The basic machine is never obsolete—*can always be re-tooled for the next job.*

The machine illustrated here precision bores blind holes approximately 13/16" diameter and 1¼" deep in grey iron hydraulic components. Parts are loaded into inclined chutes and the finish-bored parts are picked out of ejection tubes extending horizontally from the fixture—the machine runs continuously. Safety features are incorporated to protect the machine, the work and the operator.

Ask your Ex-Cell-O representative for more information on the flexible Ex-Cell-O Precision Boring Machines or write to Ex-Cell-O in Detroit for more information and complete specifications.



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never forget it. Ed won't forget it either. The next time the company wants something done, he won't be the first one to volunteer. Will industry ever learn to pick better men to handle the job of top supervision? Industry needs leaders who understand men.

Charles D. Townsend
Fort Wayne, Ind.

•

No matter what inconvenience Ed and his family are put due to the change in plans, he should just forget vacation, say nothing to the boss or Benson and Jenkins, but come in as usual, plan for the rush job getting other men he has on the job, work himself along with them and I am certain that the job would be absolutely satisfactory and out on time.

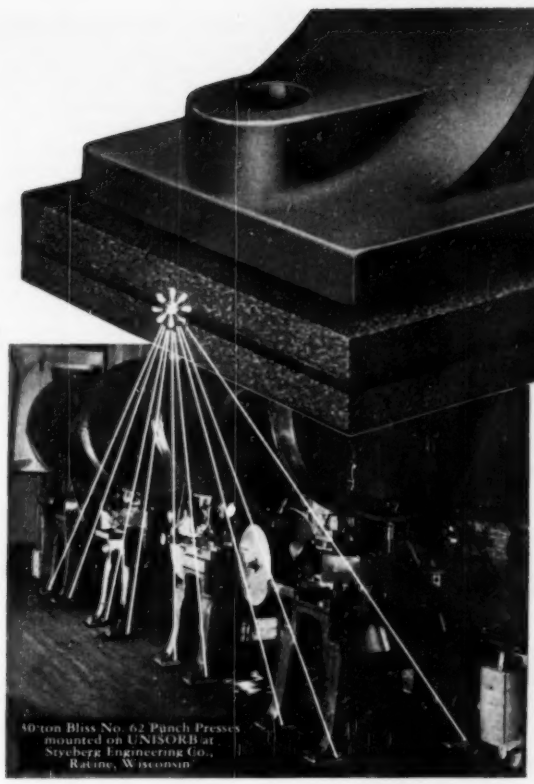
Two men however good do not make up a shop. Give others a chance and you will be surprised how much hidden talent there is in people when given the opportunity to display it, particularly when they have a chance to shine on a rush job.

Also, Ed, I would not be surprised that just when you are in the midst of this rush job the Big Cheese will walk in. And when he sees what you have voluntarily done without being pushed, giving up your vacation, he will think to himself, "Good man, he has justified my judgment in him." And when the job is satisfactorily completed your stock will go up high as far as he is concerned and that is what you want isn't it? Furthermore, you wouldn't have enjoyed the vacation under the circumstances anyhow.

On the other hand, if you didn't give up the vacation temporarily, I believe that the Big Boss would just take over and supervise the rush job and in the process tread on a few toes; then when you come back your stock would be zero. Why? You failed him just when you were needed most and seeing that he got the job out without you, when the shop did get really slack, he sees no reason to consider you. You get the gate and you deserve it.

When any man is made a boss he is in a totally different position to that of a workman. He is a small part of the managment and it is up to him to do everything possible to insure success of the concern and on this particular case Ed did not have his vacation taken away from him, only suggested to him that the rush job was very important which meant taking his vacation later on, for which of course he would be paid.

Today Ed works 40 hours a week, all regular holidays paid, plus a 2-



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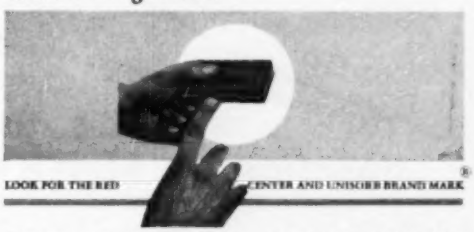

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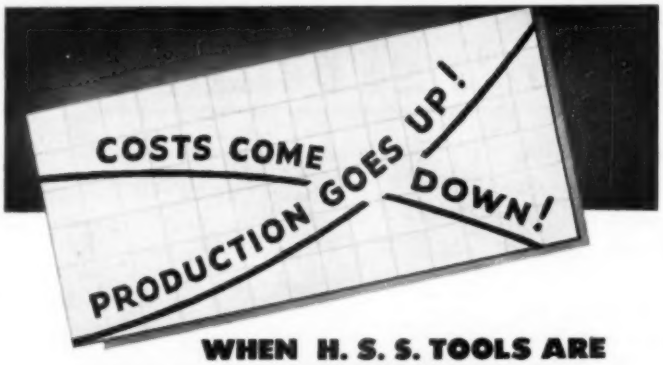

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week vacation with pay. In comparison to years ago he has got a picnic as lots of old time executives would tell you. He also gets lots higher salary, even taking extra cost of living into consideration. They have worked a 60 hour week, put in lots of overtime, paid a small salary, just about $3 or $4 a week more than the men they used to supervise, no extra pay for overtime, often working weekends on rush jobs without extra pay. You took one week's vacation when they could spare you and left your vacation address just so they could send you a wire to come back at once if a rush job came in, and if you did receive a wire to return, and it often happened, you returned or else you were punished in some way.

If Ed's department was employed on straight production line work, he would, in my judgment, be doing the right thing taking his vacation as usual, even if they were really busy, as long as he left a couple of competent men to pinch hit for him while he was away. But not under the special circumstances of this rush job coming in and the big shot's interest in getting it out as quickly as possible and the possible chance of more work from the customer, plus the fact that the company can surely use the business. It is understandable just why the big shots are giving it some of their personal attention. In fact, in lots of shops the big shot under the circumstances would have cancelled the vacation temporarily of any boss and anyone else necessary to the successful completion of the work.

If Ed ever started a small machine shop of his own and a rush job came in it is certain that he would be burning midnight oil if necessary to expedite the job, seeing that there was likely to be more work from the same customer provided the rush job was completed satisfactorily.

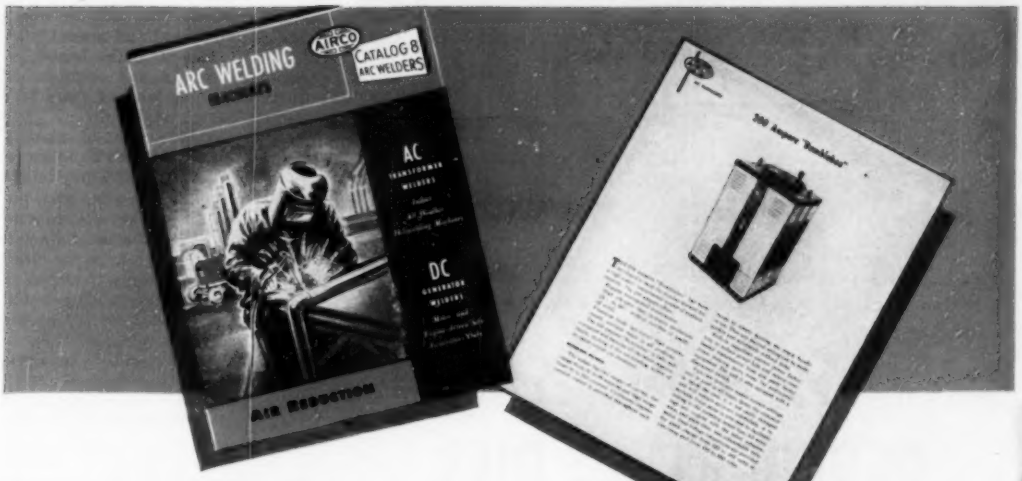
Arthur Silvester
Niantic, Conn.

•

CAN ENGINEERS COME INTO THE SHOP?

If an engineer has some new tool to develop he should get in touch with the toolroom foreman and make arrangements to have one or more men work with him in conjunction with the foreman to develop the new idea. After all, the foreman is in charge of the department and he should have full control of it and of his men.

It always is advisable for an engineer or draftsman to come to the shop and see how things are done, to get a working knowledge of how to



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- "Bumblebee" and MCT — Transformer AC Arc Welding Machines
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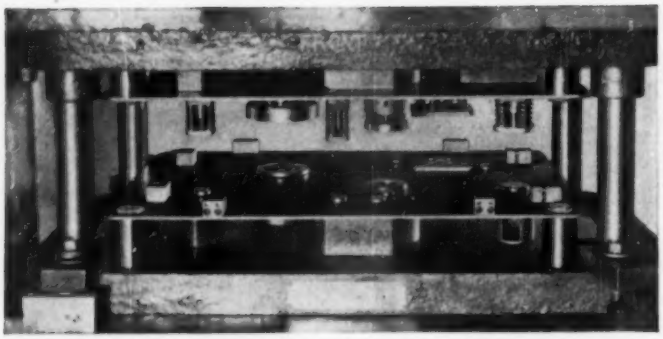

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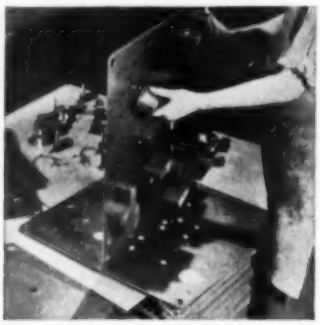

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design things so they will be workable as to material and assembly of the item. This is to the benefit of both the foremen and engineer or draftsman, when both of them talk over the design and prints.

As far as Ed's fear of making cracks, "Oh, what the hell's he know about it?" I would not worry much, as when you know what you are doing and share the knowledge with the engineers or draftsmen, they will come to you for advice. On the other hand, if the engineer is justified to make that crack, my advice would be to Ed, it's better to let people think that you are a fool than to open your mouth and remove the doubt.

Yes, Friend Ed, your other angle about your man Brown is to show that you are not on the job. If you were you would know of the changes, and if you had the knowledge the changes would be made when the drawings were brought in. You should have taken Brown in on the discussion. Then Brown and whoever there is would come to you for advice and no weight throwing would be necessary. Cooperation in anything is much better than to be a dictator. Try it and you'll find out that it is a very nice thing to do and it brings better results than dictatorship. After all, you all work for the same company and you all are getting paid to make things that are going to be sold and it is your and the engineer's job to see that the manufactured article is produced the most economical way with least cost. So forget jurisdictions and work to the most efficient way to produce. That way you and Thomas have the authority to tell Brown to make corrections.

Michael Axler
New York, N. Y.

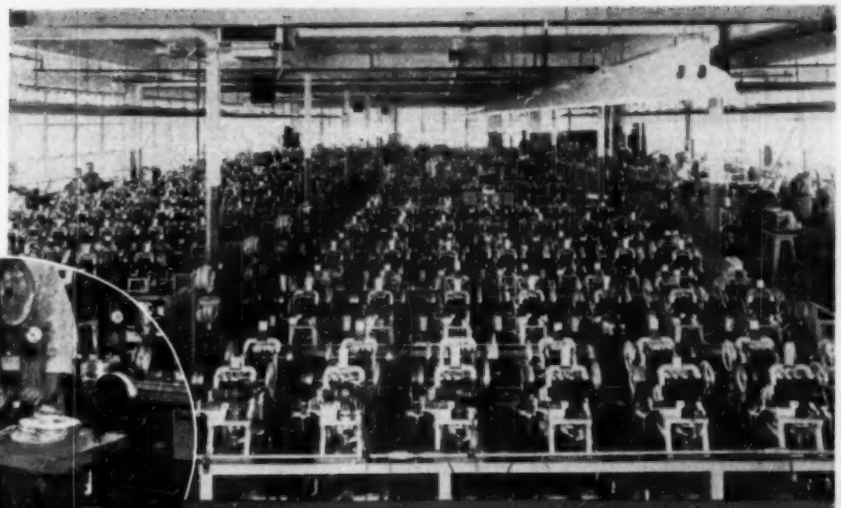
•

SUBORDINATE DICTATOR

I've known presidents of large companies who do not design the products that brought them their coffee and cakes; in many cases, they do not even have the ability to create a new design themselves. But they have judgment; they know costs; they know competitive selling markets, and they get along. How?

They know men. They recognize exceptional leadership talent, and they hire it or promote it. And then, they delegate authority and responsibility, but retain the right to judge results. In spite of what the copy books say, this type of man is not interested in details. A single personal experience will illustrate.

A few years back, I made my first



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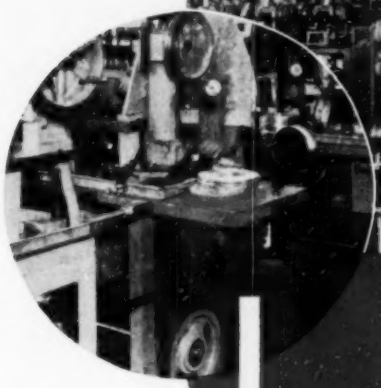

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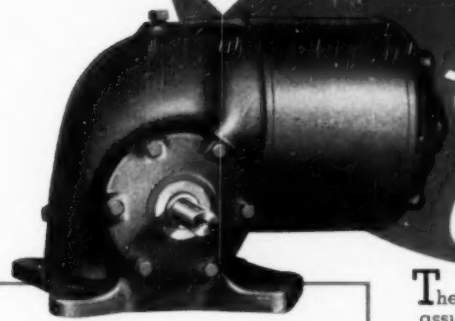

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9AL40

official visit to the office of the chairman-of-the-board who controlled the company of which I was works manager. Under my arm was a beautifully gotten-up cost-of-operations report. It was bound in a gold-lettered, pale chocolate cover. The typing radiated two gardenias worth of impeccable exquisiteness. The graphs ranged from a Ziegfield pink to a Beale Street blue. So the secretary took my report in to the sanctum—and I waited for a half hour. Then I got the nod.

Our great white father was very relaxed, and quite affable. The report lay on his desk disgustingly unopened. We conferred. He was quite interested in getting first-hand reports of a few cronies he had worked with in the shop 30 years before. I felt quite gratified. Then I learned that radios in New York taxicabs were the white man's burden, and should be suppressed. The poor quality of lemon extract that tainted the luncheon pies of a famous club was duly impressed on me. It was a swell clan meeting.

When it was time to go, the great man picked up my report—looked at one page, shook his head, turned to another page—and positively shuddered. He had a very apologetic look on his face and he shrugged his shoulders quite helplessly.

"Mr. Matter," he smiled, "You've got an awful lot of figures there. I'll bet they're important—but what would I do with them? Can't you treat me as a friend, and make it simple—say a dozen figures or so—something I can understand?"

He didn't want it, and wouldn't have it. So I picked out one figure, cost per pound of our product, and we settled on that as an index. We operated from then on, on that one figure. Of course I knew that if things did go wrong he'd hear it from other sources in a hurry—but as to details—not for him.

Ed is in his position—he picked a man who was capable; he told him the job was his. The man, Morrison, is doing his best. Were Ed to meddle in and interfere, he'd merely break a man's initiative, destroy his spirit and convince Morrison that he wasn't being trusted to carry the ball. That would be no good. Let's let Morrison keep the lathe for two weeks, retain his creative spirit and let him go home happy.

James K. Matter
Detroit

•

I just wonder who is trying to be the dictator? Al says that Morrison is not the foreman and claims that he is trying to dictate to Ed.

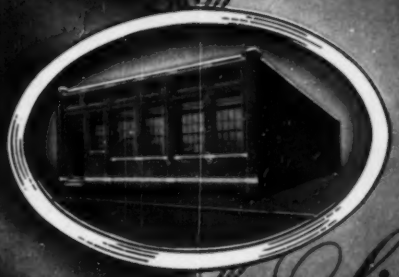
Al is trying to dictate to Ed that he should get the old lathe repaired by tomorrow morning. Al does not know what the lathe needs in the way of repairs. And if Ed does a quicker repair job and the lathe lets Al down in the middle of the run — WOW!!! — I know just who is going to get blamed.

If Ed has a man that he knows he can depend upon and whose estimate of the time necessary for a repair job is correct, he is in luck. All Ed has to do is to satisfy himself that the contemplated repairs are in line with the machine's value. If Morrison is the man he appears to be he will take pride in his job and any responsibility placed upon him will be appreciated and the company will be repaid by his work. The main thing for Ed to do is to keep outsiders like Al from coming in and trying to dictate to Morrison.

Al says that he is not letting anyone dictate to him outside of his immediate superiors. Just who does he think he is kidding? I have seen plenty of men like that, and contrary to their opinion, every one under them was doing the dictating, and they were taking it. That cranky old cuss in the corner that Al keeps because he can depend upon him in a pinch for a rush job is the biggest one of them all. Al keeps him for special jobs and because he likes to get the old boy's goat. The old man goes into an act whenever he wants something and declares that he will not have it and puts on quite a show as to what he will do if he is required to use the new tool he hears is going to be bought. When Al shows it to him and tells him he has to use it or get out the old man blusters but what Al misses is the wink the old fellow gives his benchmate while Al is going into HIS act to MAKE the old fellow use it and understand WHO is the dictator.

If Morrison knows his job, and I think he does, he is in a better position to tell how long it will take to make certain repairs. Also his experience enables him to tell that a certain machine needs repairs long before some of the modern machine runners get it into their thick heads. By making repairs before a machine quits plenty of time can be saved even tho at the time the machine was doing good work.

Personally I have told men that certain machines needed repairs. The bearings should be replaced for instance, and suggested that the work be done before the machine let them down. After they explained that the machine was running all right and that I was only looking for a job they have come to me later and



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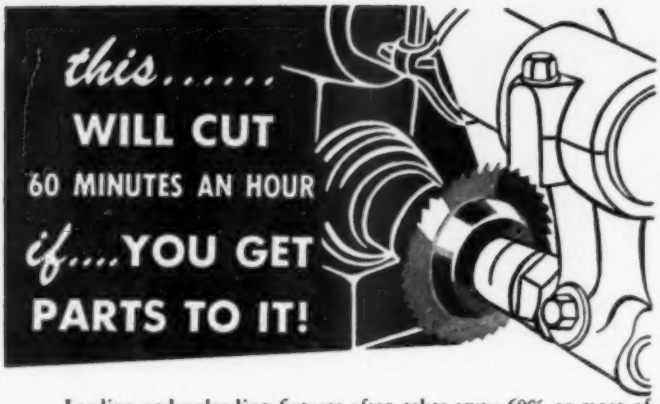

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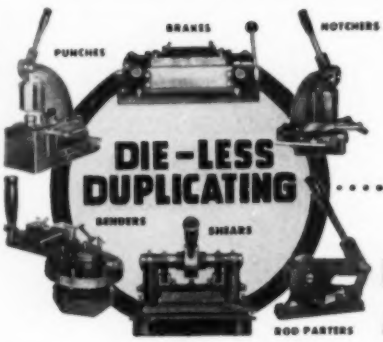

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asked me to drop everything and get the machine going as it had quit.

Now they were in the middle of a rush job and in addition to needing new bearings the machine had a badly galled shaft that had to be replaced. Instead of a half-day job they now faced a three-day shutdown.

It pays to have a man like Morrison to look the machines over occasionally and anticipate the necessary repairs. Then steps can be taken to shut the machine down at some convenient time and make the repairs instead of having it quit during a rush job. Sometimes too a rush job can be held off a day or two to let the repair crew finish their job when if the breakdown occurs during the run it is just too bad.

When Morrison says it will take a week to make certain repairs he is not dictating. He is only stating a fact. When Al insists on a quicker repair job he is doing the dictating.

Sometimes a quicker repair job is necessary to get a machine going and get the job out but a quicker repair should never be demanded when a real job should be done and the time can be taken to do it.

Let the circumstances do the dictating, not somebody who wants to make a show.

Chas. O. Rankin
Ontario, Cal.

•

Good foremanship implies proper delegation of responsibilities to subordinates. However, when responsibility for one phase of an executive's job is shifted to a subordinate, he should be given proper authority to carry out his assignment. On the other hand, the wise subordinate should make every attempt to avoid being an unyielding or even a benevolent dictator when it comes to carrying out the functions of his job. By engendering confidence through adequate performance of his phase of the work, the future course of his actions will require no excuses or explanations. Some subordinates thrive and grow under the stimulus of added responsibilities. That's how good executives are made. When the foreman has found and developed a good assistant whose chief job it is to keep the equipment in shape and anticipate repair needs, he is taking an unnecessary load off his own shoulders.

Added responsibility for the subordinate develops his capability and fosters executive leanings. The foreman should choose the best man, basing his judgment on ability, experience and attitude, for sharing

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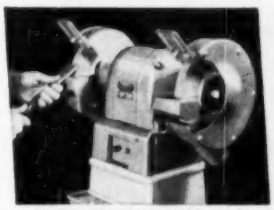

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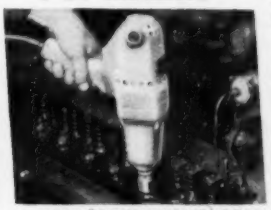

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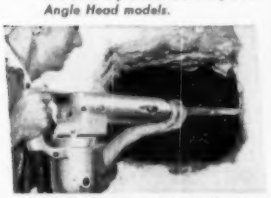

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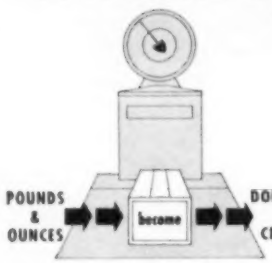

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some of the unpredictable problems that arise in operation of a shop.

The far-seeing intelligent foreman is providing a safety factor in his shop setup by shifting some of his responsibilities to the shoulders of a capable assistant. The strain of unusual pressure on an executive often brings to light the need for providing capable assistants. Why wait until it is too late before taking action to lighten the burden of the mass of details from the foreman's shoulders?

Delegation of inspection of equipment and tools to a specified subordinate will relieve the foreman of routine duties of this nature, and will help in checking waste consequent upon the use of defective auxiliary equipment and tools. The subordinate inspector is not looking for trouble in trying to anticipate repair needs; experience has shown that manufacturing departments unaided by inspection service do not maintain quality and quantity of product satisfactorily. Inspection is, therefore, the price paid for high quality and continuous production insurance. Inspection provided by the assistant to supplement the efforts of the foreman to keep production rolling should be designed as a helpful, necessary service, not as an antagonistic force. Subordinate inspection will guard against laxity with respect to equipment and tool maintenance. A check will thereby be provided by separate administration of the inspection function. The subordinate, periodically checking up on the condition of machines, cutting tools, and accessory equipment, is in a good position to note and prevent faulty production quickly and will greatly aid the production foreman in maintaining desired quality and output.

The alert, energetic subordinate inspector in the shop comes to know machines intimately. With increasing ability, he not only recognizes and anticipates repair needs readily, but appreciates the cause of the trouble and is competent to offer constructive suggestions to the foreman for its elimination. Such intelligent inspection on the part of the assistant will supplement the broad duties of the foreman and should be readily welcomed and fostered by that individual.

The foreman's faith in the subordinate may not blossom overnight, but is usually based on mutually satisfactory experience. Both the subordinate and the foreman are a team, and a team is only as good as its members succeed in making it. Two-way loyalty will obviate the undesirable tag of "subordinate dictator."

Harry Kaufman
Philadelphia

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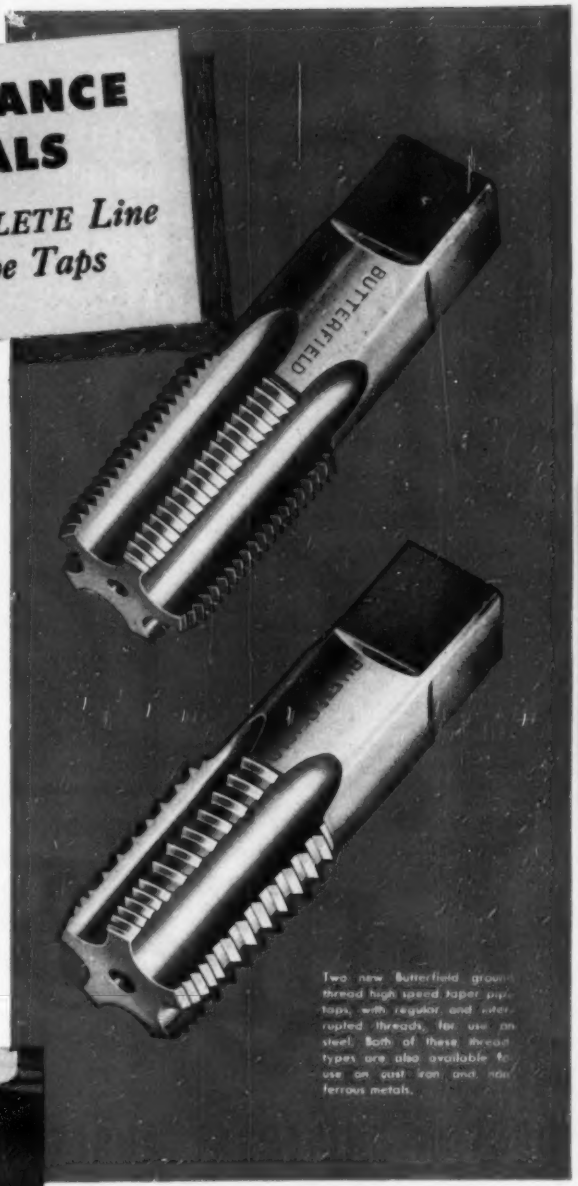

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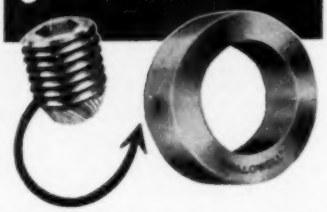

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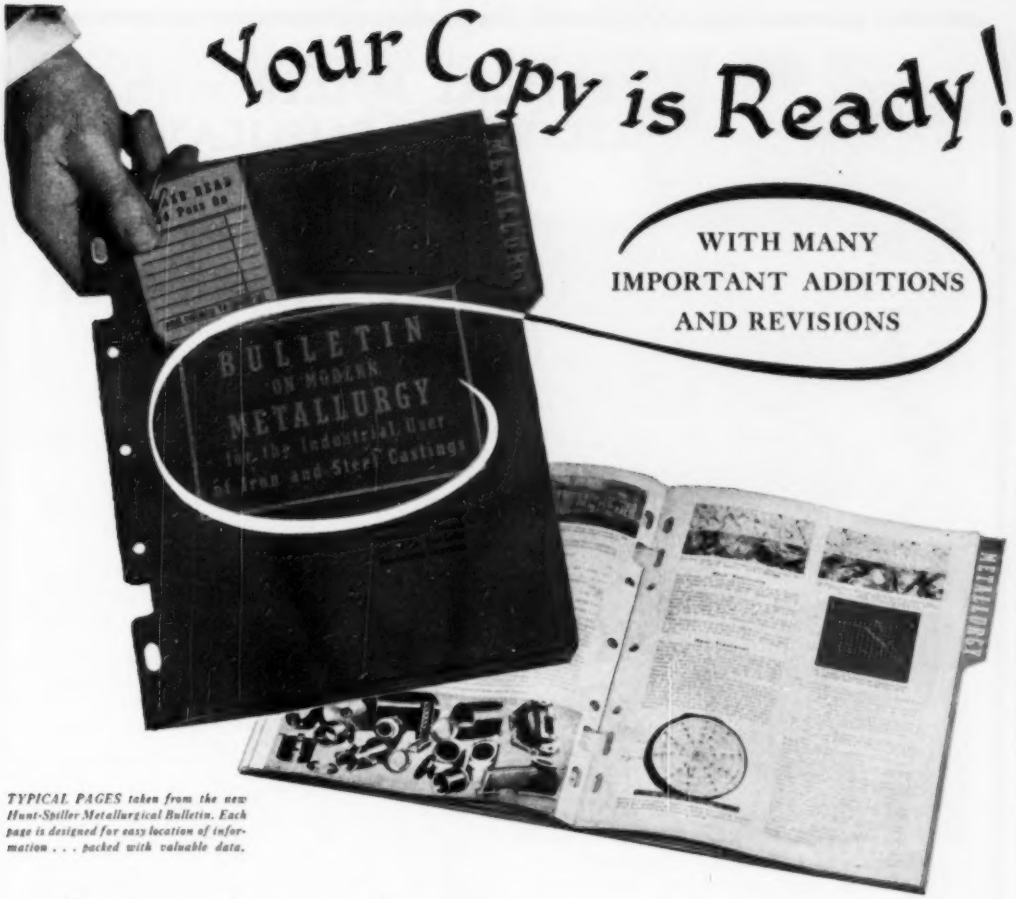

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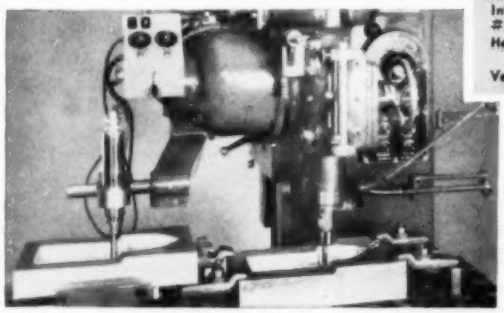

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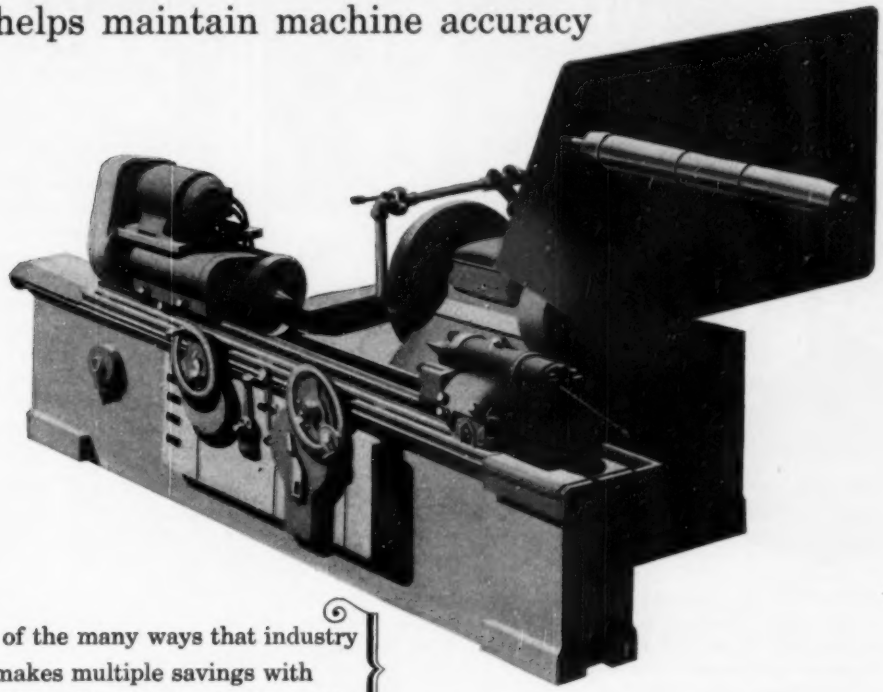

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"Rapid Tests for Identifying Alloy Steels," a Special Report from February 24 *American Machinist*, a rapid, economical method for identifying valuable alloy steels which have lost their identifying markings is explained by Elbert C. Kirkham, one of the country's oustanding authorities on spot testing of metals.

Seventy-first of our Special Reports since war's end, "Rapid Tests for Identifying Alloy Steels" is another graphic example of how *American Machinist* brings metal working production management a steady flow of authoritative help in promoting a better, more economical use of every important material of manufacture. Whether it be ferrous or non-ferrous metals or plastics Metalworking turns *first* to *American Machinist* for the information it needs and seeks.

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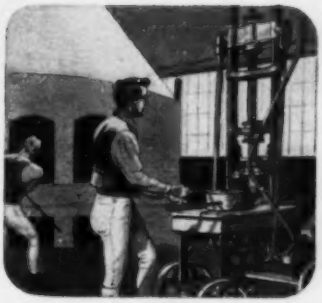
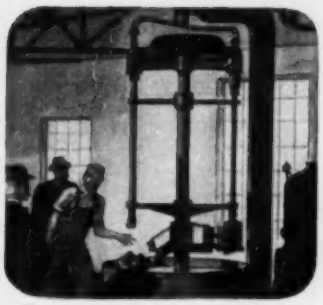
American Machinist

The McGraw-Hill Magazine of Metalworking Production
McGraw-Hill Building, New York 18

1 **1621**—Glass was money! America's first glass factory was actually a mint—not for the manufacture of coins but to make glass beads for *use* as money when buying land, food and furs from the Indians.



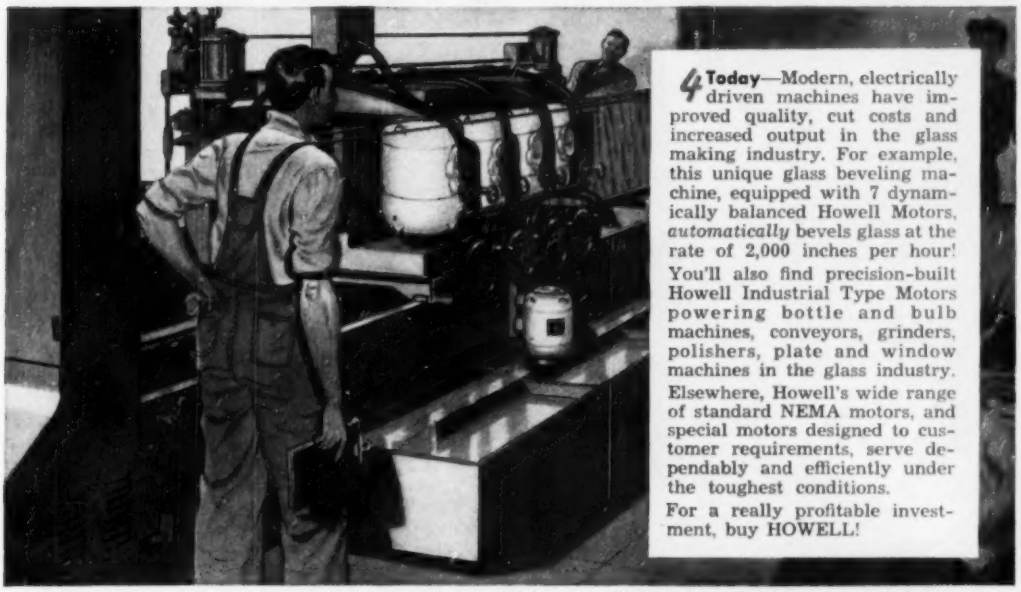
2 **1827**—Blown glass was the rule until Enoch Robinson, a carpenter, figured glass could be *pressed* into shape . . . the glass pressing machine was born. Electricity to power new machines was still to come.



3 **1899**—Owens invented a machine to make bottles as the machine age arrived in glass. By 1915, Howell "Red Band" Motors were making important contributions to this and other industries.

ANOTHER HOWELL SUCCESS STORY

GLASS...from artisans to automatic machines



4 **Today**—Modern, electrically driven machines have improved quality, cut costs and increased output in the glass making industry. For example, this unique glass beveling machine, equipped with 7 dynamically balanced Howell Motors, *automatically* bevels glass at the rate of 2,000 inches per hour!

You'll also find precision-built Howell Industrial Type Motors powering bottle and bulb machines, conveyors, grinders, polishers, plate and window machines in the glass industry.

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Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

MAHON

YOU CAN CUT COSTS ON JOBS LIKE THESE!

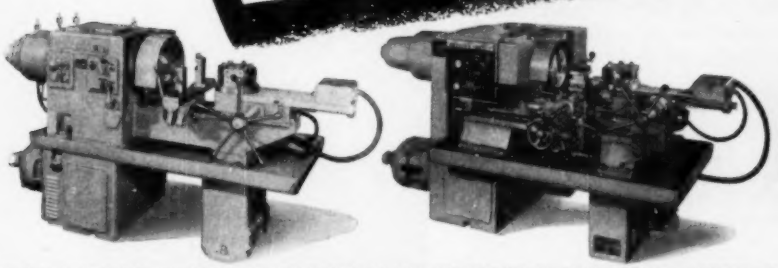
Get a stop watch. Go into your shop to the nearest conventional turret lathe. Clock the total time it takes the operator to make a piece. (Floor to floor time.)

Then, on the next piece, **start** the watch when **each** tool **starts** to cut, and **stop** it when **each cut** is over. That gives you the actual time that any tools are engaged with the work piece. (Total cutting time.)

Compare the two times. The time spent when no tools are cutting (work and machine handling time) will surprise you. **That** is where the Electro-Cycle Turret Lathe reduces production time and operator fatigue.

The next time a Warner & Swasey Representative calls, ask him what an Electro-Cycle can do on your jobs, either on brass or plastics—or on hard metals. Better still, don't wait! Call the nearest Warner & Swasey office or write.

Machines illustrated below: (Left) 16" Electro-Cycle for all non-ferrous turning; (Right) No. 2 and No. 3 Electro-Cycle for turning all metals.



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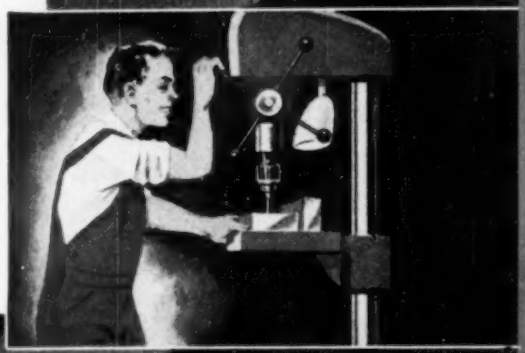

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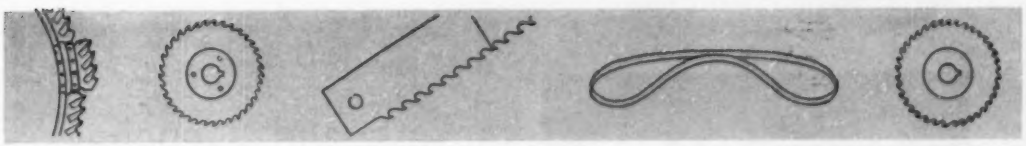

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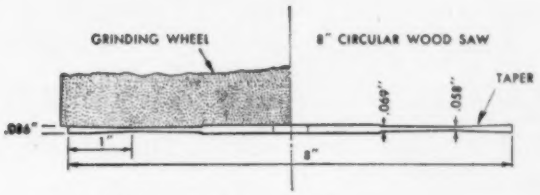
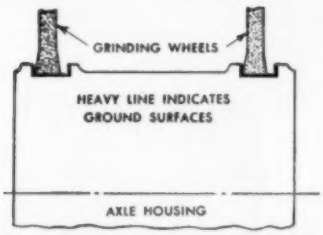
In a wider range of industrial applications



TRUFORMING MACHINE GRINDS CIRCULAR WOOD SAWS

IN 2½ MIN. FORMER TIME 8 to 10 MIN.

This Thompson Circular Saw Truforming Machine grinds 8 inch high carbon steel wood saws in 2½ minutes. Formerly this job required 2 operations and 8 to 10 minutes on a circular single chuck grinder. Machine is available in 6 to 12 inch and 6 to 16 inch sizes.



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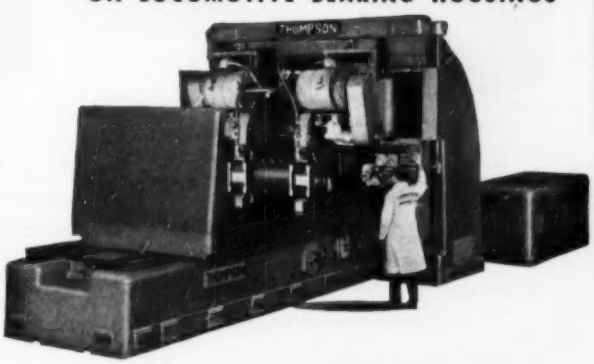
HYDRAIL GRINDER DOES

3-DAY JOB IN 2 HOURS

ON LOCOMOTIVE BEARING HOUSINGS



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Thompson SURFACE Grinders

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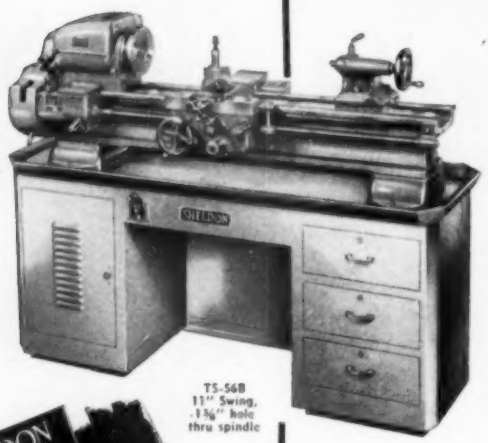
66 *variations* of 5 modern machine tools



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1⅛" hole
thru spindle

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12" Back
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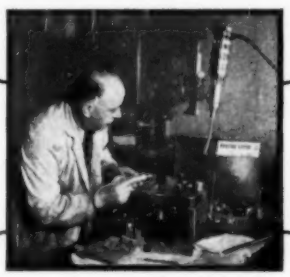

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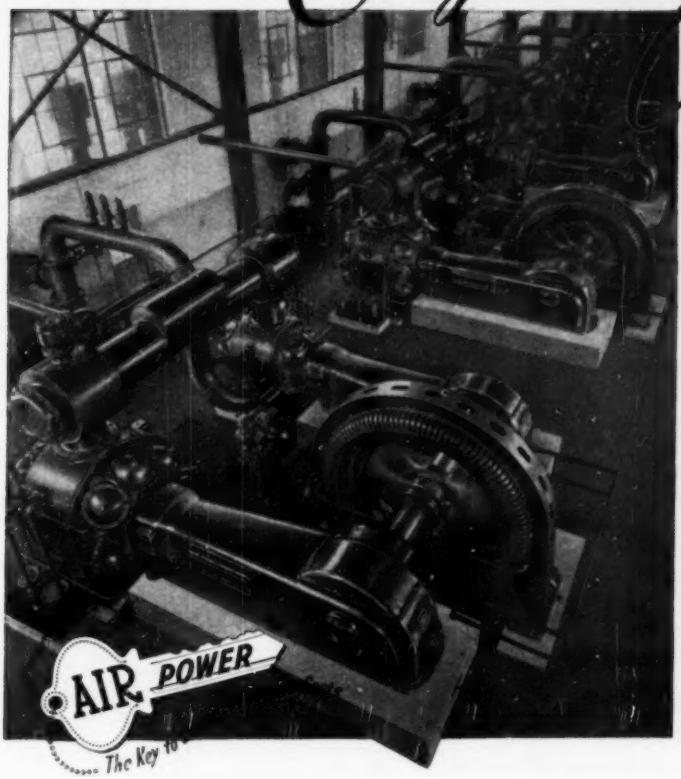
PRECISE SUPER 40

BACK OF *Every* INGERSOLL-RAND *Compressor* ARE THESE *Sup R values*



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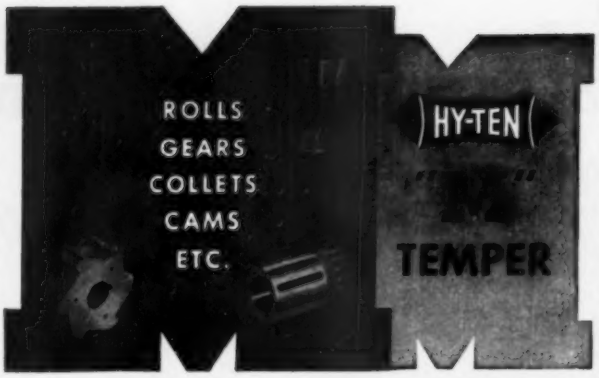

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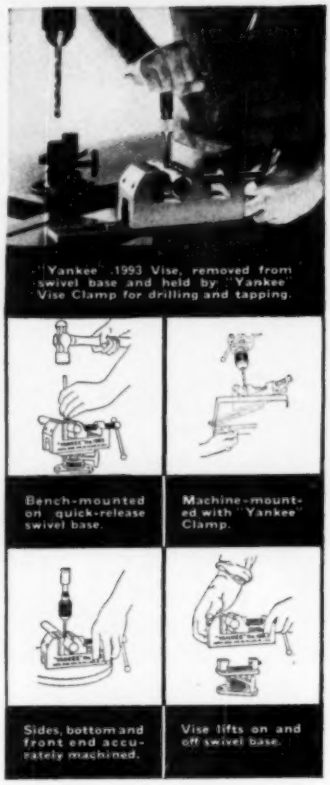
"Yankee" 1993 Vise, removed from swivel base and held by "Yankee" Vise Clamp for drilling and tapping.
Bench-mounted on quick-release swivel base.
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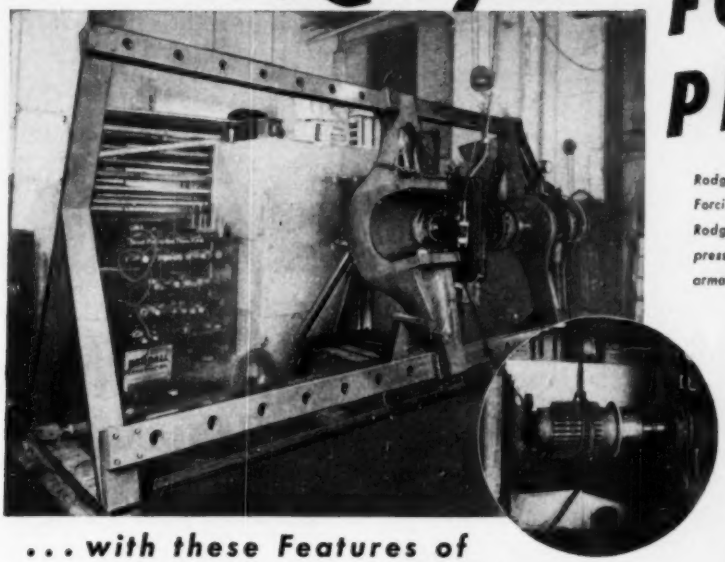
New Rodgers FORCING PRESSES



Rodgers 300 Ton, 75° Inclined, Stationary Forcing Press, one of many in the complete Rodgers line. In the application shown, the press is being used efficiently to press an armature shaft.

...with these Features of Construction and Operation

- **SEPARATE PUMPING UNITS**—Choose from individual hand-operated or power-driven pumps to operate any model Rodgers Forcing Press.
- **REMOTE CONTROL OF POWER PUMPS**—Operator can control press from any desired position.
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- **EXPERTLY ENGINEERED AND CONSTRUCTED**—All units of Rodgers Forcing Presses are made strong, durable and dependable to give years of reliable service.

...Separate Power Pump

Select your press operating unit from hand-driven pumps or power-driven pumps. Shown is a Rodgers 2-cylinder Power Pump with remote control.

...In these Types and Sizes

Rodgers Versatile Forcing Presses are available in portable or stationary models—horizontal, vertical, 75° or 90° inclined—100 to 600 tons—with hand-operated or power-driven pumps. In this broad selection, you'll find the ideal press to meet your requirements.

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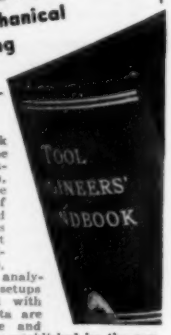

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TOOL ENGINEERS HANDBOOK

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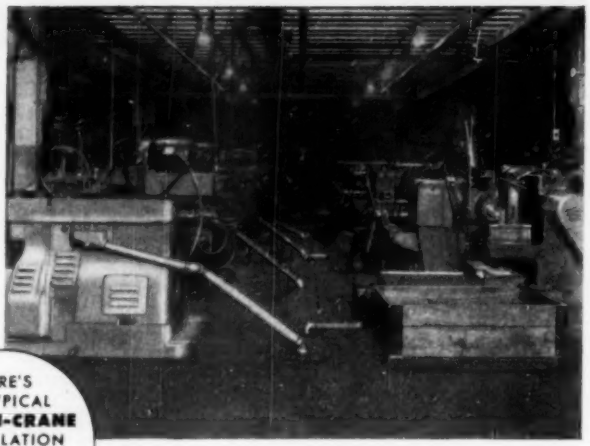

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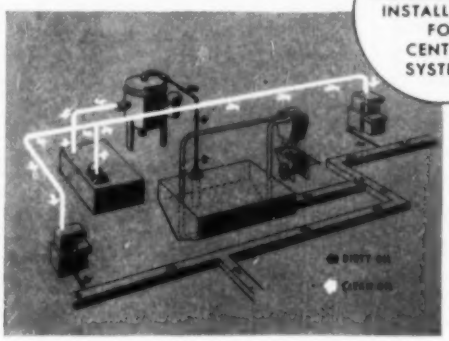

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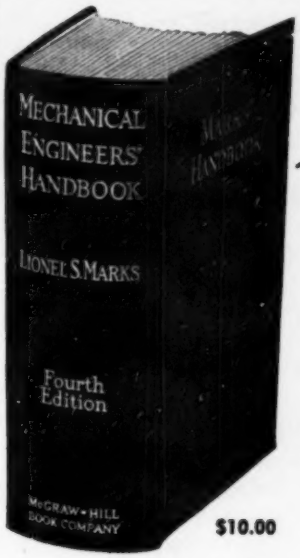

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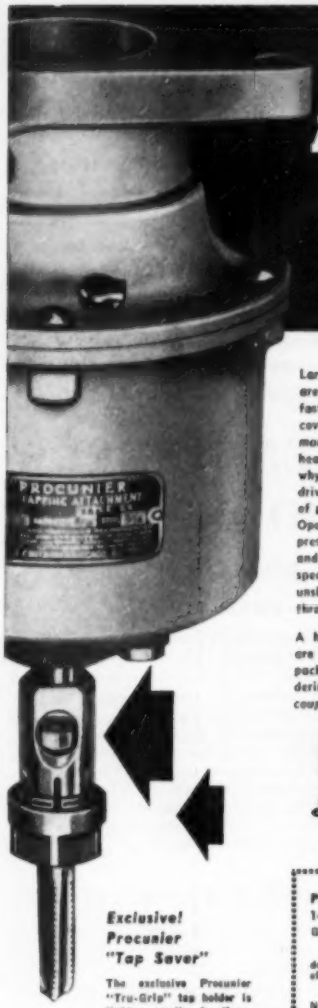

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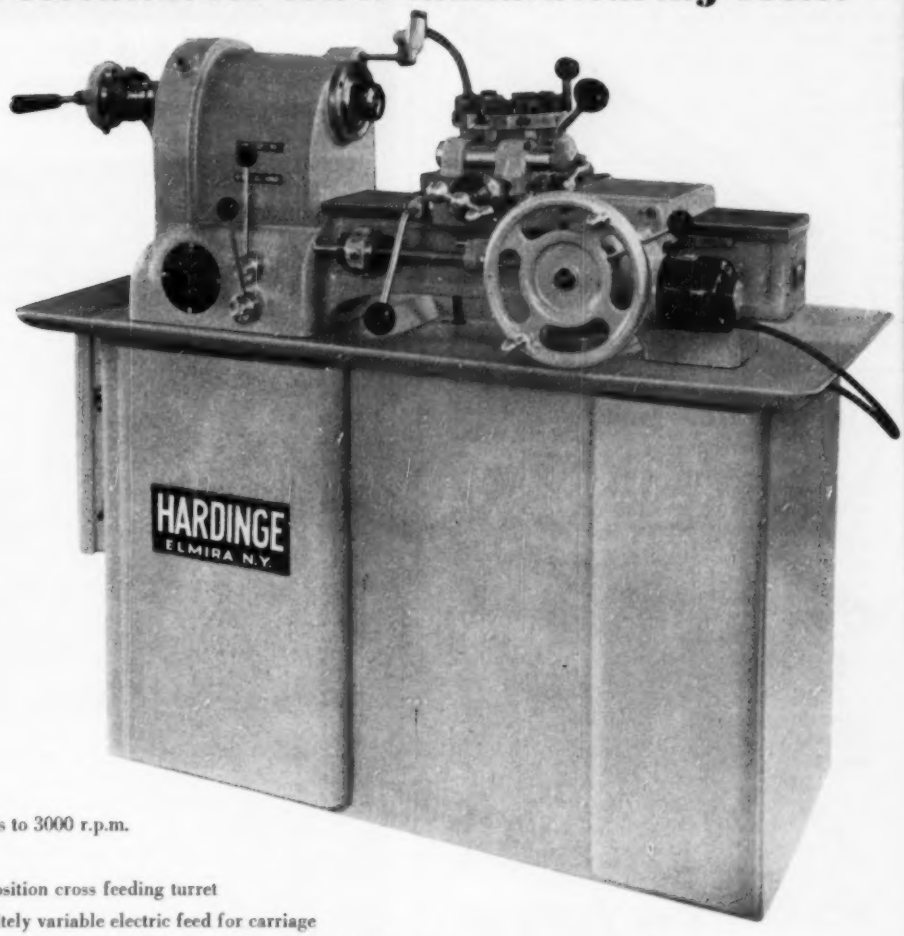

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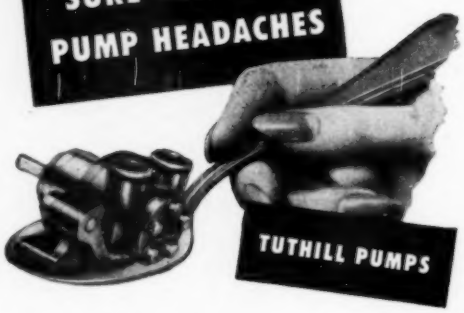

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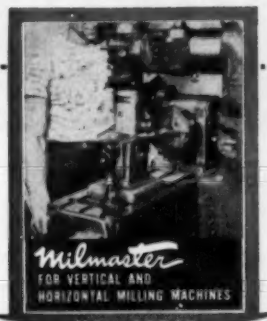

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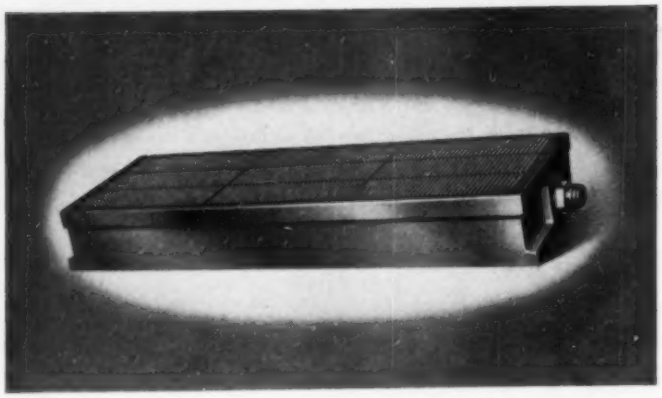

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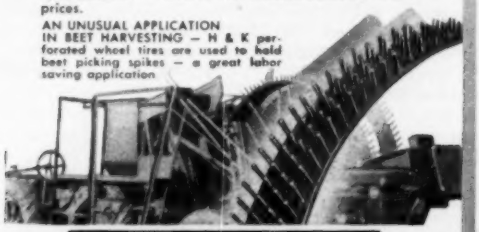

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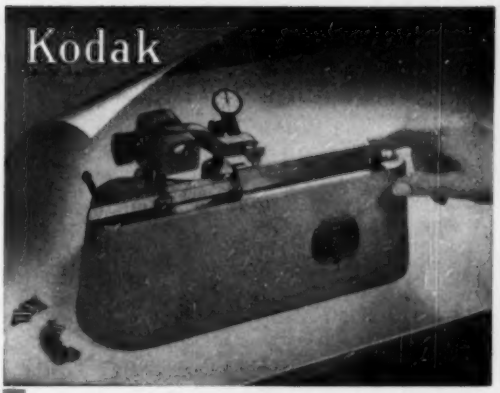

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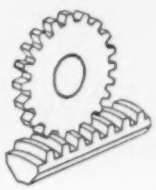

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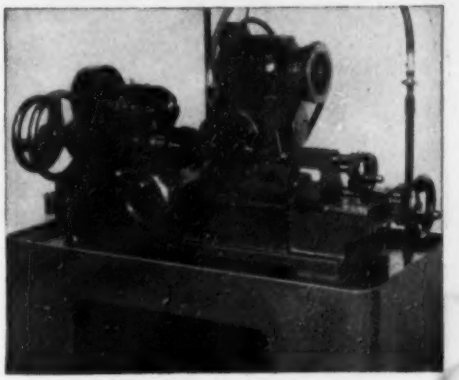
This NEW and improved machine provides semi-automatic milling of accurate, fine-finished threads in diameters of 2" or less . . . at a low cost in time and effort. It is now mounted on a heavy welded steel cabinet in which are located electric control panel and complete coolant unit consisting of motor-driven pump and tank. Chips are held on a removable screen pan. Coolant is returned from top of cabinet base to tank by a readily movable pipe.

Cutter and work spindles are each driven by individual motor. This machine will cut from either brass or steel through a simple change in speed ratios. Cutters for any form of thread can be furnished by Waltham.

Standard equipment includes: point centers for head and tailstock, draw-bar for collet chucks, dog driving plate, 60°V cutter, 13 change gears, indexing device, lighting fixture and follow rest.

With work held on centers, threads 8¾" can be cut. With work held in draw-in collet, capacity is 10" length of thread. Diameter of hole through draw-in collet is ⅝". Swing over carriage is 3".

Write for illustrated literature giving full details.



ATTACHMENTS AVAILABLE

Taper Bar, Lever Chuck Closer, Translating Gears, Climb Milling Device, Internal Cutter Head, Multiple Cutter Head and Collet Chucks.

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HIGH STREET, WALTHAM, MASS.

WALTHAM

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Economy

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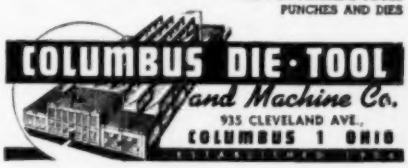

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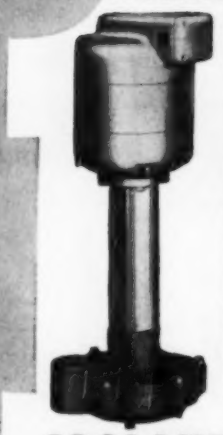

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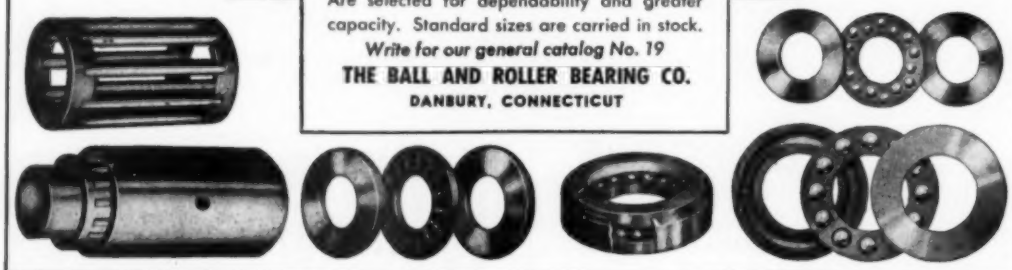

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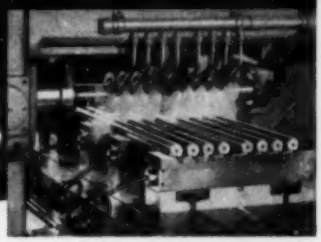
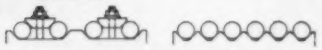
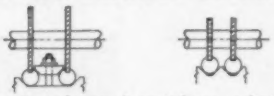


1. Get More Pieces On Table



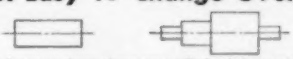
Elimination of mechanical clamps reduces required width of fixture . . . makes possible the milling of more parts per table load.

2. Use Smaller Cutters



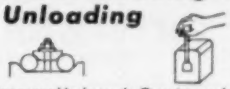
Because no clearance is required over mechanical clamps.

3. Easy to Change Over



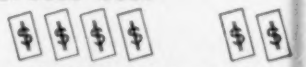
In illustration shown above, parts milled include straight shafts, step shafts and crankshafts. Twenty different parts are machined — changeover from straight to step shafts only a matter of adding a height spacer.

4. Faster Loading and Unloading



No clamps need be loosend. Operator merely presses a pushbutton or throws a simple switch lever.

5. Less Cost



In installation illustrated above, magnetic fixture cost is approximately half that of a mechanical clamp fixture designed to handle same range and types of parts.

FREE *Additional Data*

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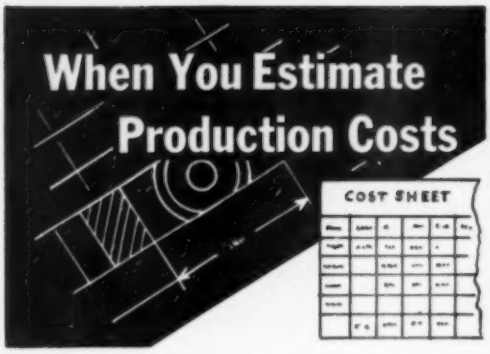

How Much Do You Allow for VIBRATION?

Where plants have vibration problems of any kind, production costs are higher than they need to be.

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Vibration Control can help shave costs of Labor, Materials and Overhead, and although the individual savings may seem too *small* to bother with, they can add up to a total too *important* to be overlooked—with competition the way it is today. For instance,

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Vibration causes excessive machine wear. Control vibration and your operators spend more time producing—less time watching the machine being repaired or adjusted.
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Vibration from punch presses, hammers and other disturbers has often led to the practice of segregating them. Control vibration, and you get a better plant layout, with machines where they belong for straight line work flow—and you save on materials handling costs.

MATERIALS—Vibration transmitted from other machines can seriously impair the quality of work in process on rigidly mounted grinders and other precision machine tools. Control vibration by isolating the vibrating machine or the precision tool, and you reduce rejects and work spoilage.

OVERHEAD—Vibration requires extra maintenance of plant and equipment, and decreases useful machine life. Vibration control will keep these costs down.
Vibration often increases costs for foundations and floor construction. Vibration control, properly engineered, can often reduce or entirely eliminate foundation requirements—or permit lighter floor construction. It frequently makes it possible to install impact machinery on upper floors.
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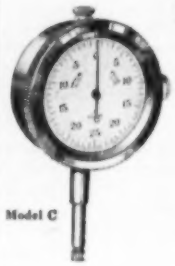

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HEADQUARTERS FOR BUSINESS INFORMATION

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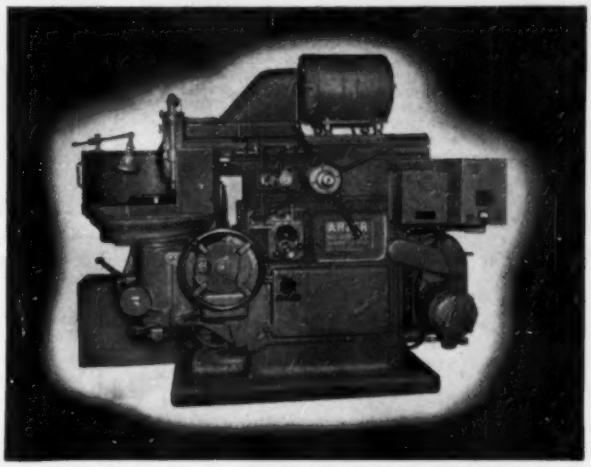

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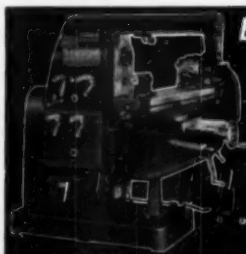

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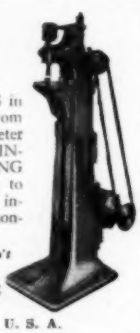

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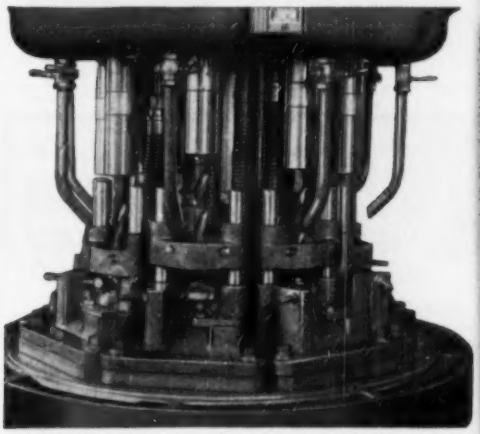

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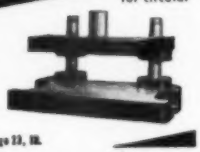

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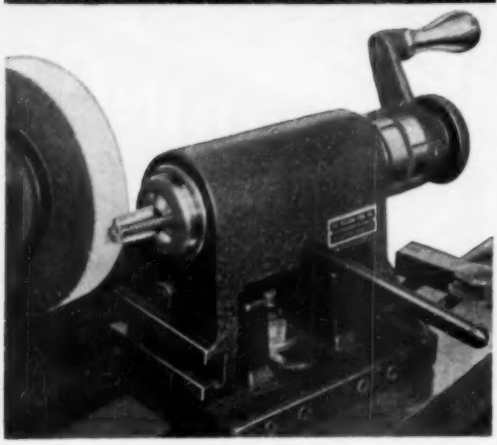

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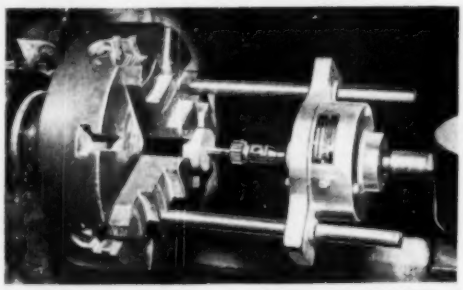

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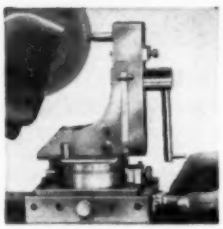

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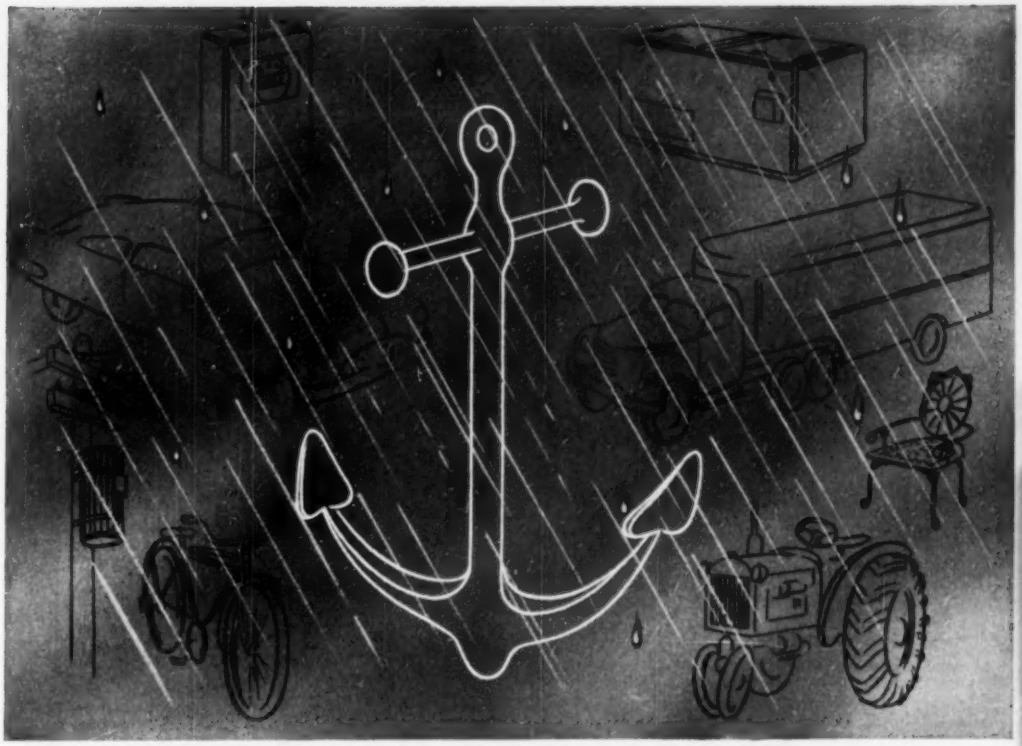

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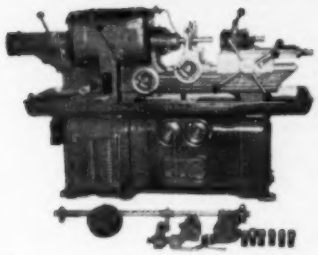

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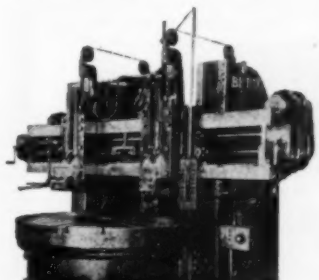
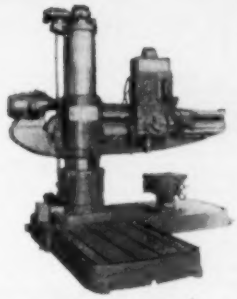
42" Gisholt Vertical, Motorized.
120" Niles, B & Pond Vertical



Betts 100" Vertical Boring & Turning Mill. 1944 machine. 2 plain heads. Complete Electrical.



Cincinnati-Bickford 6'-19" SUPER-SERVICE Radial Drill. New in '42. Standard base plus angle base. 36 spindle speeds. Necessary motors & controls.

RADIAL DRILLS

Cinci-Bickford 6' Arm, 15" Col. 24 Speeds.
Cinci-Bickford 5' Arm, 13" Col. 24 Speeds.
Cinci-Bickford 4' Arm, 13" Col. 32 Speeds.
Cinci-Bickford 3' Arm, 9" Col. 12 Speeds.
Cinci-B. Super-Service 4'-11".
Mueller 3'-11" Universal. M. Dr.

MILLING MACHINES

Milwaukee #2B Dble. Overarm, Horiz.
#1M Cincinnati Horiz. Rect. Overarm.
#3 Dial Type, H.S. Cincinnati Vertical Mill.
#2, #3, #4 Cincinnati High Power Vert.
#4-36 Cincinnati 4-Spdle. Duplex Hydromatic.
#4-36 Cincinnati Plain Hydromatic.
Sundstrand #0 Hydraulic Feed Rigidmill.
Cincinnati #0-8 Automatic Horizontal.
Cincinnati #0-8 Vertical.
Cincinnati #2-18 Automatic Horizontal.
Brown & Sharpe #12 (Electrics Built-in) 24".
Nichols Hand Mills (Late Type).
Van Norman #3V Ram Type Vertical Mill.

UNIVERSAL MILLING MACHINES

B & S #2, 20"x5"x17½".
B & S #1½, 20"x7"x18'.
Bridgeport, 20"x9"x16" Turret Type.
Garvin #2MU, 24"x8"x18".
Kempsmith #2, 28"x8½"x18".
Cincinnati #2M, 28"x10"x18".
B & S #3, 34"x10"x21".
Cincinnati #3S 34"x12"x20".
#4 & #5 Cincinnati High Power Horiz.

PUNCH PRESSES

O.B.I. Toledo #5, 44 tons cap. motor dr.
O.B.I. Bliss #18, 19C, 20, 20B, 21 motorized.
O.B.I. Michigan, 36 tons cap. Wide ram & bed.
#68C Bliss Dble. Action 3-Crank.
#91C Toledo Sgle. Act. Dble. Crank S.S.
#305 Bliss S.S.S.A. 95 tons Cap.
#3A Bliss S.A.S.S. Dble. Crank. 42 Tons.
Zeh & Hahnemann 35 Tons S.A. Cam Release Spring Return. 220/440 motor.

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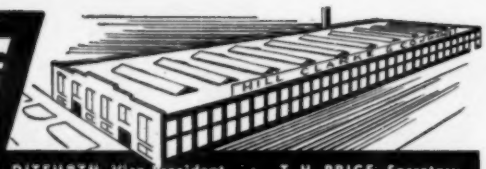

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AUTOMATICS
1⅝" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1⅝" (1942)
No. 6 Brown & Sharpe, M.D.
No. 49 New Britain, 4 Spdl. Chucker
Model A 1½" Cleveland (1943)
Model A 3¾" Cleveland (1942)

DRILLS
No. 2—28" Defiance #3 Taper (1943)
No. 150 Baker, (1942)
No. D8 Colburn, No. 6 Morse Taper
No. 4-BM Fosdick 4 Spdl. (1942)
No. 6-BM Fosdick 6 Spdl. (1942)
No. 1-LMS Leland-Gifford's (1942)
No. 2-LMS Leland-Gifford's (1942)
No. 4BL Natco 36 Spdl. (1943)
5' Western Heavy (1942)
6'-17" Fosdick Hyd. Economax Radial

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 10H Gould & Eberhardt
72" Cincinnati Gear Cutter

BORING MACHINES
No. 350—T Giddings & Lewis 5" Bar
No. 360-F Giddings & Lewis 6" bar
No. 2 Lambert 4" bar
No. 31 Lucas 3" bar, M.D.
No. 46-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
36" Bullard Hi-Speed (1942)
42" Bullard (1944)
42" Colburn, M.D.
80" Colburn, M.D.
72" Niles Extra Heavy
84" Betts, M.D.

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
10"x96" Landis type C hydraulic (1942)
Norton Motorized Grinders ranging from 6"x18" 24"x240"
12"x48" Cincinnati Univ. (1946)
Bryant Internal Grinders (1942)

LATHES
14"x30" centers Pratt & Whitney, Model C
18"x34" centers LeBlond (1941)
18"x6' American, Gdr. Head, M.D.
16"x54" Monarch
20"x72" centers Monarch
20"x8' American Geared Head M.D.
36"—48"x16' Lehman Hydratrol (1945)
36"x24' Lodge & Shipley Gdr. Head
8"x15" Sundstrand, Model D (1943)
10" Sundstrands (1942, 1943)
16" & 20" Fay Automatics (1942)
No. 2 Warner & Swasey, Bar Fd. (1942)
No. 4 Gisholt Univ. Turret Lathe, (1942)
No. 4R Libby, Bar Feed (1942)
No. H-5 Libby
No. 5 Bardons & Oliver (1942)
No. 5 Midland, Bar Feed (1943)
No. 1-H Libby, Extra Long Bed (1942)

MILLING MACHINES
No. 2H Milwaukee Plain (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cincinnati Mfg. (1942)
No. 2—18" Cincinnati Rise & Fall (1941)
No. 2—18" Sundstrand-Electromil (1942)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex (1943)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 56-72 Cincinnati Hydromatic
No. 56-90 Cincinnati Hydromatic
4½"x12" Pratt & Whit., Model C Thread Mill
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1942)
12"x24" H.T. Lees-Bradner (1942)
24"x24"x12' Ingersoll Adj. Rail Slab Miller
36"x24"x12' Ingersoll Duplex Miller (1946)
36"x36"x16' Ingersoll Slab Miller, 4 Hds.
No. 10 Ingersoll 72"x8' Travelling Col. Face Millers (1942)
No. 28-60 Cincinnati Hydrotel

MISCELLANEOUS
18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners

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36"x36"x12' Cincinnati
36"x36"x18' Gray Maxi Service, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

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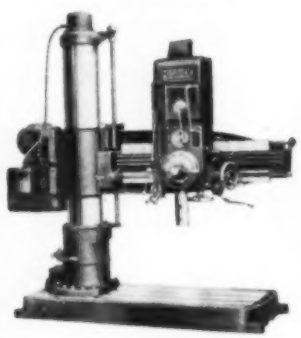

5' Arm 17" Col. Fosdick "ECONOMAX" Hydraulic Radial Drill. Spindle Speeds RPM 20 to 1406. Late type.

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Cin-Bick 3' & Morris 3½' Arm Radial Drills
De-All 8 x 24" Horiz. Sp. Hyd. Surface Grinder
Blanchard M.D. Vert. Sp. Surface Grinder 20" chuck
L & S 20" x 8', 18" x 12', 20" x 10', 28" x 12'
Monarch 20" x 8', Amer. 20" x 12' grd. hd. q.c.g. m.d. Engine Lathes
B & S Nos. 2-B & 3-B, Cin. No. 3 Mil, No. 2-B & 3-B, Cin. No. 5, LeBlond No. 4, Grd. Hd. Plain Millers
B & S No. 2-A & 3-A, Mil. No. 2-B, Cin. No. 1-M, Cin. No. 2, Grd. Hd. Univ. Millers
Avey 2-Spindle MAS Drill Press late.
Niagara 12' Power Square Shear, 10-Ga. 18" gap late

MONA MOWER

Cin. #3 Vert. Miller Late
Cin. 24" M.D. Univ. Shaper.
Cleveland 48" x 12' Table Open-side Planer, 3 Hds.

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Potter & Johnston #4D Timken Head, A.C. M.D. Chucker
Heald No. 49 Boromatic, 2 Spindle Hydraulic Cross Table
Fisher, 5" Bar Floor Type Horizontal Boring Mill, AC-DC Drive
Gorton 3L—Three Dimensional Pantograph with Cutter Grinder
Bliss O.B.I. & Double Crank Presses
U. S. Tool Nos. 22, 25, 33 Multi-Slides
NILSON & BAIRD FOURSLIDES

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LATEST TYPE *Nearly New* MACHINES

BORING MILLS—Horizontal

CINCINNATI GILBERT 3½" bar, floor type, latest
DEFIANCE & HARVEY 6" bar, Floor Type, M.D.
GIDDINGS & LEWIS #787, 4½" bar, Latest Type
HEALD 48, 49 single end, Semi-matic, Latest
LANDIS—#35—6½" bar, floor type, M.D.
LUCAS #41, 3" bar, Table Type, Latest Type
LUCAS #43, 5" bar, Table Type, Late Type
NILES-BEMENT-POND 5", 8" bar, Floor Type, M.D.
UNIVERSAL 8" bar, high speed, latest type

BORING MILLS—Vertical

BULLARD 16" 6-spindle Mult-Au-Matic Type D, Latest
BULLARD 12" 6-spindle Mult-Au-Matic Type D, Latest
BULLARD 24" 36" Turret "New Era" Slide Head, M.D.
BULLARD 24", 36", 42" Vert. Turret "Spiral Drive" High Speed, Latest Type
COLBURN 72", 2 swivel heads, PRT, M.D.
KING 60", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, Rapid Traverse, AC M.D.

BROACHES

AMERICAN V-2, 6 ton Hyd., Latest Type
CINCINNATI 1-30, 2-30, Duplex Vertical Surface, Hyd., Double Ram, Model KR, Latest Type
LaPOINTE 8-36 Vertical, Hyd., Latest Type

DRILLS—Miscellaneous

BARNES H-3 "Hydram," Hydraulic, 3" capacity—for inverted drilling, Latest Type
LELAND & GIFFORD #1LMS, 4 Spindle, Latest Type
LELAND & GIFFORD —3, #2MS, Single Spdle.
LELAND & GIFFORD #2LMS 2 and 4 spindle, Latest
NATCO #4AL Multiple, 30 spindles, Hyd., Latest Type

DRILLS—Deep Hole

BARNES 420/3 Spindle Hydraulic, Latest Type
LeBLOND #3 Single Spindle, Hydraulic, Latest Type

DRILLS—Radial

AMERICAN 4' arm 11" col. "Hole Wizard." Latest
AMERICAN 4' plain Triple Purpose, Motor Drive
AMERICAN 5' arm 12" column Plain, M.D.
CINCINNATI BICKFORD 5'13" Column, Plain, M.D.
CIN. BICKFORD 6' arm 15 col. Plain or Univ., M.D.
DRESSER 5' arm 15" column Univ., M.D.
WISCONSIN 6' arm 20" column Plain, Latest Type

GEAR CUTTING EQUIPMENT

BARBER COLMAN Type A Hobber, Latest Type
BARBER COLMAN #12 Hobber, single and Double Overarm, Motor Drive
BILGRAM 6" and 16" cap., Bevel Gear Gen., M.D.
BROWN & SHARPE 8-8u Gear Cutter, Motor Drive
BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
CROSS #1 Tooth Rounding Machine, Motor Drive
CROSS #50 Universal Gear Chamferer, Latest Type
FELLOWS 6I, 6IA, 6Z2, Model Z, 7A, 7, 72, 75S, 77 High Speed Gear Shaper, Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #15LS Lapper, latest type
FELLOWS 8M Rod Lifter, Latest Type
GLEASON #14 Hypoid Spiral Generator, Latest Type
GLEASON 5", 12" straight bevel generator, latest type
GLEASON #4, #6, #18 Bevel and Hypoid Tester
GLEASON 24", 17", 96" Straight and Bevel Gear Planer, Motor drive
GOULD & EBERHARDT 04H Hobber, with diff. M.D.
PRATT & WHITNEY 10" Grinder, Hyd., latest
SCHUCHARDT & SCHUTTE #1 Hobber, Motor Drive

GRINDERS—Cyl.—Plain & Univ.

BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
BROWN & SHARPE #2 Plain, 2 x 12, Latest Type
LANDIS 6x18, Plain Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd., Latest Type
LANDIS 29"x130" Plain Roll, Motor Drive
NORTON 6"x18", 8"x30", 14"x36", 16"x72" Type C, Plain, Latest Type

GRINDERS—Miscellaneous

BARBER COLMAN #3, #4 Hob Sharpener, Latest
BROWN & SHARPE No. 13 Hair Cutter & Tool, Lat.
BRYANT #3, #6, 16-C-16, 16-CF-16, 24-36" Internal, Hydraulic, Latest Type
CINCINNATI #2, Centerless "Filmatic", Latest
CINCINNATI "Monoset" Tool & Cutter, Latest
FITCHBURG 14"x25" Spline, hydraulic, latest
GARDNER 24-8a, D"ic Grinder, Latest
GLEASON #18 tool sharpener, Latest Type
HEALD 72AS, 72AB "Gagematic," Internal, Latest
HEALD 74A 72AS 72AB, 74, 76A Internal, latest
HEALD #31 Internal, Centerless, Sizematic and Gagematic, Latest Type
KEARNEY & TRECKER Face Mill Grinder, Latest
JONES & LAMSON 6x15, 8x48 Auto Thread, latest
LANDIS #6, 6x24 Thread, latest type
LANDIS #13 Centerless, Hydraulic, Latest Type
La POINTE 60" Universal Broach Sharpener, Latest
THOMPSON 8"x45" Auto., round broach, M.D.
VAN NORMAN #672, #696, #690, #75 Oscillating Radius Grinder, Latest Type
VAN NORMAN #666 Crankshaft ReGrinder, Latest

GRINDERS—Surface

BLANCHARD #11, 16" dia. mag. chuck, Latest
DO-ALL Model G-7, 9"x20", Hyd., Latest Type
BLANCHARD 16A Vertical, Dial Feed, Motor Drive
G&L (GRAND RAPIDS) #45, Hyd., 12"x24", Latest
HANCHETT series 300 12"x48" Vert. Hyd., Latest
HANCHETT #36 Vert., 36" dia. mag. chuck, Latest
HANCHETT #120, 30x120" Plano, Hyd., Horiz., Latest
HEALD #23 Rotary, 18" chuck, latest type
HEALD 33A—rotary—16" and 36" chuck, Hyd., Latest
NORTON 6x18 Hydraulic, latest type
THOMPSON 12x12x36 Type D Hyd., Latest Type

JIG BORERS

KEARNEY & TRECKER Model B, Automatic, Latest
PRATT & WHITNEY 1A, Master Drive
SOCIETE GENEVOISE (SIPP) #4 Precision, M.D.

LATHES—Engine and Mtg.

AMERICAN 16"x54", Centers, Geared, Motor Drive
AMERICAN 42"x200" Centers, 1 carriage, Motor Drive
AMERICAN 26"x240" centers, 2 carriages, motor drive
BRIDGEPORT 36"x25' bed—3 carriages, M.D.
HENDEY 12x30", 14x30", Timken, Latest Type
JONES & LAMSON "Fay" 20x30", 24x24 autom., latest
LeBLOND 21"x96" Centers, Geared, Motor Drive
LEHMANN 16x36" centers, TIMKEN, latest type
LODGE & SHIPLEY 16"x30", 14"x30" Timken, Latest
LODGE & SHIPLEY 18x72 centers, M.D.
LuWINU 6x60, 6x96, 8x96, 8x144, Latest
MONARCH 16"x30" centers, Model RR, Timken, latest
MONARCH 13"x30" Centers, Model CKK, Timken, lat.
MONARCH 17"x54" Centers, Model CK, Timken, latest
MONARCH 16"x16" Centers, Model CW, Latest
MONARCH 22"x456" Centers, 3 Carriages, Timken Bearing, Model CM, Motor Drive
MONARCH 36"x54" Ball Bearing, Geared Head, M.D.
NILES 20"x50" Boring "Time Saver" Timken, Latest
PRATT & WHITNEY 16"x30" Centers, Timken, Latest
PRATT & WHITNEY 16"x30" centers, Bench, latest
PUTNAM 42"x25' Centers, Motor Drive
REED PRENTICE 20"x54" Centers, Model A, Latest
SOUTH BEND 14½"x20" Centers, Toolroom, Latest
SPRINGFIELD 16"x30" centers, Timken, latest type
WARD, HAGGAS & SMITH—18/30x58" centers gap, motor drive, Latest Type

LATHES—Hob and Cutter Relieving

CLEVELAND 12"x16" Centers, Cutter, Motor Drive
MICHIGAN 1712 Universal, Latest Type
U.S. TOOL #810B, 8"x15" Centers, Cutter, Latest

LATHES—Turret

BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #4FU "Fastermatic," Timken, Latest
GISHOLT #1L, #3L, #5L Universal, Timken, Latest
GISHOLT #3, #4 univ., TIMKEN, Latest Type
JONES & LAMSON #3, #5 Univ., Timken, Latest
LIBBY "International" 1025 Univ., Timken, Latest
MOREY No. 2G, No. 3, No. 4, Timken Bearing, latest
POTTER & JOHNSTON #5DIR, Timken, Latest
WARNER & SWASEY 5, Universal, Timken Bearing
WARNER & SWASEY #3, #3, Timken, Latest type
WARNER & SWASEY 2A Universal, Timken Bearing, "Pre-selector" Bar and Chucking, Latest Type
WARNER & SWASEY 3A Universal, Timken Bearing, Bar and Chucking, Latest Type

MILLING MACHINES—Mfg.

HALL Style L, Planetary, latest type
INGERSOLL 12"x48" rail, 4 heads, AC, M.D.
INGERSOLL 32x24x18" Planer Type, 2 heads, AC, M.D.
INGERSOLL 30x24x18' sdl. rail slab, M.D.
SUNDSTRAND Model 2A Duplex 42" feed, Latest
TAYLOR & FENN M30 Duplex Spline, latest

MILLING MACHINES—Plain

BROWN & SHARPE #2, Light Type, Timken, Latest
BROWN & SHARPE #12, 24" feed, Latest
BROWN & SHARPE #000, Timken, Latest Type
BROWN & SHARPE #2B, 3B, Timken, Latest Type
CINCINNATI 0-8, 1-12, 2-18, Automatic, Latest Type
CINCINNATI #3, #4, #5 High Power, Late Type
CINCINNATI 4-36 Hydromatic, Simplex, Latest Type
KEARNEY & TRECKER #2H, 3H, 4H, 5H, Latest
KEARNEY & TRECKER 1218, 1404, Simplex, Latest
KEMPSMITH #9G, #1, Timken, Latest Type
KEARNEY & TRECKER 4K, Timken Bearing, Late

MILLING MACHINES—Thread

LEES BRADNER Model L7, 6"x26" Centers, Latest
LEES BRADNER Model HT, 12"x54" Centers, Latest
MOREY 12x36", 60", 120", 180" centers, Latest Type

MILLING MACHINES—Universal

BROWN & SHARPE No. 3A, Timken Bearing, Latest
BROWN & SHARPE No. 5A, 6A, Motor Drive
CINCINNATI #2MH, Timken, Latest Type
KEARNEY & TRECKER 3H, Timken, Latest Type
KEMPSMITH #6 Maxi-miller, Timken, latest Use
VAN NORMAN #3 Duplex, Motor Drive
VAN NORMAN #2K, #3K, Timken, Latest Type

MILLING MACHINES—Vertical

BROWN & SHARPE #2 Standard Timken, Latest
CINCINNATI #4, Dial Type, High Speed, Latest
CINCINNATI #2, Dial Type, Timken, Latest
CINCINNATI #6H, TIMKEN, Latest Type
GORTON #1, 24" Duplex Shaper, Latest Type
KEARNEY & TRECKER 2H, 2K, 3H, Timken, Latest
MOREY 12M Single & Double Spindle Profiler, Latest
REED PRENTICE 3VG, with or without hydraulic duplicator, Timken bearing, Latest Type

PLANERS

BETTS (CONSOLIDATED) 84"x96"x18' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
BETTS (CONSOLIDATED) 108"x84"x36' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
CINCINNATI 96"x30"x12' 4 heads, PRT, DC, M.D.
DETRICK & HARVEY 48"x16"x16' 4 heads, Hydraulic, Rapid Traverse, A.C. Motor Drive
NILES 108"x84"x42' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
NILES 42"x42"x14' "Time Saver," Box Table, 3 Heads, PRT, VARI-VOLTAGE Drive, Latest
NILES 96"x96"x24 4 heads, Rapid Traverse, Box Table, D.C. reversing motor drive

PRESSES

BIRDSBORO 325 ton, vert. hyd., Latest Type
BLISS 75-35 Hydro-Dynamic, Double Action, Latest
GLEASON 18" Squeezing, Hyd., Motor Drive
HENRY & WRIGHT 50 ton Dieing, Roll Feeds, M.D.
LAKE ERIE 500 ton Vert., Hyd., Latest Type
NILES 400 ton, Horiz. wheel, Motor Drive

SCREW MACHINES—Automatic

ACME GRIDLEY 2" Model RAS, 6 spindle, Latest
BROWN & SHARPE 2G, 1" capacity, M.D.
CLEVELAND 9/16", Model A, Latest Type
CONOMATIC 1⅛", 6 spindle, High Speed, Latest
CONOMATIC 2⅝", 6 spindle, high speed, Latest Type
GOSS & DeLEEUW 6"x6¾", 5 spindle Chucker, Tool rotating, Latest Type
GOSS & DeLEEUW 8" 5 spindle Chucker, Work Rotating, Latest Type

SHAPERS & SLOTTERS

AMERICAN 20" Heavy Duty, Motor Drive
DILL 20" 24" Vertical, Motor Drive
GOULD & EBERHARDT 20", 22", High Duty, M.D.
PRATT & WHITNEY 6" Vertical, M.D.
ROCKFORD 36", Hydraulic Shaper-Planer, Latest

SHEARS—Power

WYSONG & MILES #372, 14 gauge x 6', Latest Type
QUICKWORK #5, ⅝" Cap., Rotary Shear, M.D.
QUICKWORK #6, 1" Cap., Rotary Shear, M.D.

MISCELLANEOUS

AJAX 2", 3½" Forging and Upsetting, M.D.
BAKER #3 Keyseater Motor Drive
BARNES #172, 306H, 307, 307B Vertical Hone, Hyd. Self-Oiling, Latest Type
CAMPBELL #401 Abrasive Saw, Latest Type
DE LAVAL #194 Coolant Clarifier, Latest
FOSTER 6"x18", 4"x36" Superfinisher, Latest
HELLER Model 88-1 Cold Saw, 6" cap., M.D.
LANDIS 8" Single & Double Spdle. Bolt Threader, M.D
MANVILLE 2D 7/16" Cap. 888D, Ball Header, M.D
NAZEL #6B Pneumatic Hammer, M.D.
NORTON #2F 10U Vertical Lapper, Latest Type
PRATT & WHITNEY (KELLER), Type BL-2416 Type G Copying, 2 and 3 dimensional, Latest Typ
ROWBOTTOM Cam Miller, Motor Drive
WATERBURY FARREL #20 Thread Roller, MD

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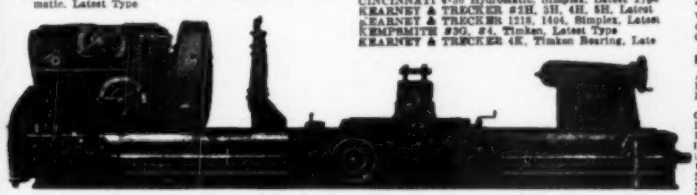

NILES 60"x55' Centers "Time Saver" Heavy Duty Engine Lathe—2 carriages, Power Rapid Traverse with each carriage, Latest Type (NEW 1943)

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(Partial List) Over 2,000 Machine Tools in Stock. Your Inquiries Are Invited . . . Prompt Service Is Assured

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LATEST TYPES — GUARANTEED MACHINE TOOLS 1941-1946 MODELS

MILLING MACHINES

MILWAUKEE—2H Universal, N.S.
MILWAUKEE—2K Vertical, Sliding Head, N.S.
CINCINNATI—2M Vertical, Rotary Table
CINCINNATI—No Vertical
CINCINNATI—4-36, 4-48, 45-48, 58-96 Plain Hydromatics
CINCINNATI—48-96 Hydromatic Rail Type, 2 Vert. Heads, Tracer control
SUNDSTRAND—3S—Rigidmill, 2 Vert. Heads
SUNDSTRAND—9S—Rigidmill, Duplex—(arr. for milling the cam tracks in propeller hubs or similar work)
SUNDSTRAND—9S—Rigidmill, Hydraulic
BROWN & SHARPE—No. 19 Plain, Production
BRIDGEPORT—Vertical, Turret, Hand Feed
MOREY—No. 12M 2-spindle Profiler
TAYLOR & FENN—N-66 Duplex Spline
RICE BARTON—Model K Duplex Spline
DECKEL Type—Die Sinker & Engraver (new)

THREAD MILLERS & TAPPERS

HANSON WHITNEY—6"x10" Thread Miller
MOREY—12"x60" Thread Miller
LEES-BRADNER—#40A Thread Miller
HALL-PLANETARY—Type "B" & "C" Thread Millers
KAUFMAN—5A—Tapper, Lead Screw Type
MURCHEY—#22—Tapper, Horizontal

GRINDERS—THREAD

EXCELLO—No. 21 & No. 23 External
JONES & LAMSON—TG-636 External
JONES & LAMSON—TG-1245 External
JONES & LAMSON—TG-125 Internal

GRINDERS—CYLINDRICAL

LANDIS—6"x12" Type "H" Hydraulic, Plain
LANDIS—8"x18" Type "C" Hydraulic, Plain
LANDIS—18"x18" Type "C" Hydraulic, Plain
LANDIS—18"x32" "Type D" Crankpin, Hydraulic
CINCINNATI—8"x18" Hydraulic, Filmatic
CINCINNATI—10"x72" Hydraulic, Filmatic
NORTON—12"x36" Model "C" Universal
BROWN & SHARPE—No. 5 & No. 10 Plain

GRINDERS—INTERNAL

HEALD—72A5 Plain, Fixed or Cross Feed Hd.
HEALD—72A1 Plain, Cross Feed Head
HEALD—72A3 Universal, T-Bed
HEALD—72A5 Sizematic
HEALD—72A3 Sizematic Centerless
HEALD—172 Gap Bed, Sizematic
BRYANT—112 Universal, Hydraulic
BRYANT—10-28 Hole Grinder
BRYANT—24-36 Heavy Duty
RIVETT—No. 104 Tool Room Grinder

GRINDERS—RADIUS

VAN NORMAN—No. 73 Oscillating Internal
VAN NORMAN—No. 649 Oscillating, Internal
VAN NORMAN—No. 659 Oscillating, External
VAN NORMAN—No. 3½ Radius, Universal

GRINDERS—SURFACE

THOMPSON—9"x12"x18" Type "B" Hydr.
THOMPSON—6"x12"x24" Type "B" Hydr.
THOMPSON—12"x10"x24" Type "BB" Hydr.
THOMPSON—12"x12"x40" Type "B" Hydr.
THOMPSON—12"x16"x48" Type "C" Hydr.
THOMPSON—12"x18"x96" Type "C" Hydr.
THOMPSON—24"x16"x60" Type "B" Hydr.
THOMPSON—30"x36"x120" Type "C" Hydr.
HEALD—No. 72 Rotary, 12" Mags. Chuck
ARTER—Model A-1, 8" Rotary
GARDNER—Model 120A Opposed Hd. Disc Grinder

HONING MACHINES

MICROMATIC—Model H-510 Hydrohoner, D.E.
MICROMATIC—Model H-2 Hydrohoner, S.E.

LAPPING MACHINES

NORTON—No. 26 Hyprolap
NORTON—Model 28" x 96" Hand Lapping
CINCINNATI—No. 2 Centerless
ULTRA-LAP—No. 10 Lapping

GEAR & SPLINE GRINDERS

PRATT & WHITNEY—10" Single Wheel
PRATT & WHITNEY—10" Double Wheel
PRATT & WHITNEY—16" Single Wheel
GEAR GRIND. MACH. CO.—GG-33 (16"x42") & GG-19 (10"x24"). Hydr. for Spur Gears and Splines
GLEASON—No. 17 for Spiral, Zerol and Hypoid Bevel Gears

GEAR CUTTING MACHINES

FELLOWS—No. 6I Gear Shaper
FELLOWS—No. 72 Gear Shaper
FELLOWS—No. 7 Gear Shaper
FELLOWS—Straight Line Generator
FELLOWS—Model Z Horiz. Shaper
GLEASON—3" Bevel Gear Generator

GEAR FINISHERS & TESTERS

FELLOWS—6LSI & 15LSI Gear Lappers, External & Internal, Spur & Helical
FELLOWS—No. 12 Shaver, Crowning Attn't.
GLEASON—Nos. 4 & 6 Bevel Gear Testers, hand & power operated
GLEASON—No. 15 Bevel Gear Tester, Univ'l.
ILLINOIS—No. 224 Involute Checker with or without recorder
MICHIGAN—No. 1124 Involute Checker with recorder
NATIONAL BROACH—Model SIC-12" Gear Tester

PRECISION BORING

HEALD—48A Borematic, S.E., 2-Sp. & 1-Sp.
HEALD—47A Borematic, S.E., 2-Spindle
HEALD—49 Borematic, D.E., 4-Spindle

LATHES — PRODUCTION

POTTER & JOHNSTON—6D Automatic
LODGE & SHIPLEY—3A Duomatic
LIPE-ROLLWAY—15"x30" Carbomatic
MICHIGAN TOOL—No. 1708 Univ'l Relieving
LEBLOND—25"x48" Engine Lathe, raised to 40"

TURRET LATHES

GISHOLT—No. 3 Ram Type, Bar
GISHOLT—No. 5 Ram Type, Bar
JONES & LAMSON—No. 5 Ram Type, Bar
JONES & LAMSON—No. 7A Saddle Type, Chuck
WARNER & SWASEY—No. 3A Saddle Type, Bar
FOSTER—No. 2F Fastermatic
FOSTER—No. 4F Fastermatic

AUTOMATIC SCREW MACHINES

ACME-GRIDLEY—Mod. RA-6, 9/16" & 1", 6-Sp.
CONE—Conomatic, 1¾", 6-spindle

DRILLING MACHINES

LELAND-GIFFORD—Mod. 2-LMS Deep Hole Vert'l.
BARNES-DRILL—No. 201¼, 2-spindle, wide base
BAKER—No. 21F, Upright, M.D.
BAKER—No. 30-HO 2-spindle, Inverted
FOSDICK—Model 4BM, Upright, H.S.
PROVIDENCE ENG.—3/16" Sensitive, 8-spindle
P. & W.—½ Size Deep Hole Reamer
SUNDSTRAND—No. 53, 4"x36" Centering

MISCELLANEOUS

CAMPBELL—No. 42S Cutsletter
WILLIAMS—10" Pipe Cut Off Machine
RANSOME—No. 30 Welding Positioner
MARTIN—No. 12 Marking Machine
OLIVER—No. 2A Face Mill Grinder
OLIVER—10" Template Tool Bit Grinder
TANNEWITZ—Model GH-36 Band Saw
KENT—3¼" Bar Pointer
OSBORN—No. 194 Core Blower
OSBORN—No. 002 Jolt Rollover
DENISON—91BAM Test Stand

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UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 9—20" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 10"x16" Surface 13"x62", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x5', 8', 10'—10"x6', 3', 10'—18"x6', 8', 14'—26"x16'—all some drive, several motorized also (new) 18"x3' and 19' geared head, motorized.
Large stock 19" and 18" bench and floor type.

Planers—Single head 24"x8', 24"x8', 26"x8'.

Shapers—16", 20", 24" B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

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CRANES—Milwaukee 30 T 95' span (New)

ROLLS—Bending, 30'x¾", Pyramid
Bending, 15'x3" Vertical, Pyramid
Bending, 11'x¾" Initial

TURRET LATHE—#3L Gisholt (1942)

PLATE EDGE PLANER—32'x2"

PLANER—N.B.P., 48"x48"x26', 4 Heads

MILLER—K. & T., #4K, Plain Horiz. (Late)

SHEARS—7'x1", 8'x1½"

PRESSES—Z & H #7 50 ton, Percussion
Bliss #6, 125 ton, (late)
Clearing, 200 ton, (late)
Bliss #310, 450 ton

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32"x16" SIDNEY Herringbone Geared Head Lathe 16 speeds, 9' cc, complete with Taper Attachment Chucks, Steady Rest, Face Plate, 20 HP motor. New 1943.

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USED MACHINERY FOR SALE

1—16" Columbia Back Geared Shaper, motor driven, complete with all standard equipment. Price—$600.
1—6" Gleason Bevel Gear Generator. Serial #4303.
1—Lapointe Horizontal Twin Broach, No. 3.

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National-Senior Size
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Excellent Condition

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NORTON 6"x18" SEMI-AUTOMATIC CYLINDRICAL GRINDER, SERIAL #C 15275. MFG. 1941.
PRICE $1,450.00
Inspection in our Warehouse. Excellent Condition

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517 So. Delaware St., Indianapolis 4, Ind.

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AUTOMATICS

½", No. 0G Brown & Sharpe
9/16" Acme Gridley model R6
⅞" & 1¼" Cone 4 spindle
1⅛" Cleveland 4 spindle
1⅛" Greenlee 6 spindle
1⅛" New Britain 6 spindle
1⅞" Conomatic 8 spindle
2"x18" Cleveland model B
2½" Acme Gridley model RA6
8" Bullard Multiamatic
No. 2 FU Foster Fastermatic
No. 16 New Britain 6 spdl. chucker
14"x18" Fay chucker
No. 5DE2 Potter & Johnston

BROACHES

10 ton 36" stroke Colonial duplex surface
15 ton 36" stroke American duplex surf.
No. 1 Foote Burt duplex surface
2 ton American horiz. hydraulic
No. 3 Oilgear horiz. hydraulic
No. 10-72 Colonial horiz. hydraulic
No. 3 Lapointe screw type
10"x72" Colonial broach sharpener

DRILLS, MULTIPLE

42 spdl. No. B 16 Natco
34 spdl. No. 30 Natco
24 spdl. No. B4A Natco
22 spdl. No. 14 Natco
16 spdl. No. 2 BL Natco
12 spdl. No. 39 Natco rail
12 spdl. No. 25 Baush rail
8 spdl. No. 11 Natco

GRINDERS

No. 72A3 Heald Sizematic internal
No. 72A3 Heald Sizematic centerless
Nos. 72A3, 72A5 & 74 Heald plain
No. 75A Heald hand feed
Nos. 16A16, 16-36, 18-36, 16CP16 & 24-36 Bryant
Model MHI Sav-way hydraulic
Size 1C Greenby internal
No. 2 Cincinnati centerless
No. 10 Blanchard surface
Nos. 3 & 34 Abrasive surface
6"x24" Wilmarth Mormon surf.
12" & 16", No. 22 Heald rotary surf.
16" & 24" No. 25A Heald rotary surf.
No. 2 Norton universal tool
Model 47 Sellers tool
No. 2R6 Pratt & Whitney tool
No. 51 & 510 Oliver drill
No. 10G Sellers drill
Nos. 33 & 35 Excello thread

LATHES, TURRET

Model 6.2 Denver
Nos. 2 & 3 G Morey
No. 4 Midland
Nos. 5 & 7 Bardons & Oliver
No. 3 Jones & Lamson
No. 5 Foster
Nos. 2, 3, 4, 1A & 3A Warner Swasey
Nos. 3, 4, 5, 3AL & 28" Gisholt
24" & 36" Bullard vertical
No. 2 FU Foster Fastermatic
3"x36" & 4"x34" Jones & Lamson

MILLERS

No. 2H Kearney & Trecker univ.
No. 3 Cincinnati universal
Nos. 2A5 & 3B Milwaukee plain
Nos. 2, 3 & 4 Cincinnati vertical
Nos. 2H & 3H Kearney Trecker vert.
No. 3V Van Norman vertical
No. 3 Kempsmith Maximill vert.
Nos. 1-12, 1-18, 2-18 & 2-24 Cint. auts
Nos. 0-8 & 2-18 Cint. Rise & Fall
Nos. 3-24, 34-36, 4-36, 4-48, 5-48, 56-72 and 56-90 Cincinnati Hydromatic
Nos. 1H-12", M18, M24 & 12-24 Kearney & Trecker
30", 42" & 84" Ingersoll Rotary
Nos. 4, 8, CT36 & 40 Lees Bradner thread

PRESSES

1000 ton Southwark hydraulic
1000 ton No. 666 Toledo coining
600 ton No. 2216½ Hamilton forging
350 ton No. F1350-42 clearing
48", No. 93½ Toledo double crank

MILES MACHINERY CO.
SAGINAW, MICH.

A PARTIAL LIST OF LATE MODELS

AUTOMATICS

Brown & Sharpe #00G, H.S., #4, #6
Conomatic 8 sp. 1⅞" cap., CECO ⅝"
Fay 12"x80"
New Britain Gridley 6I—6 Sp. 2¼"

BORING MILLS

Giddings & Lewis #6, #25T, Bullard, 42" V.T.L.
Universal 3" horiz., Lucas #31 horiz.

DRILLS AND RADIALS

Canedy-Otto 3'-9" col.
Carlton 8'-19" col.,
Cincl-Bickford Super-Service 21", 24"
Natco Model E-5 Multi-Spindle, 14 spindles
Sibley 24—29", Allen 6 Sp., Excelsior 21"

ENGRAVERS

Gorton #3U, 3Z, 3L; Deckel GK.I
Gorton Cutter Grinders 375-2, 260-5

GEAR EQUIPMENT

Barber Colman #3 Hobbers and sharpener
Fellows #645Y, 72, 725 High Speed, Mikron Gear Hobber
Michigan, Gleason, Fellows Checkers
Gleason 3" Generator
Gleason #2 Surface Hardener
Hamilton #4E Hobber

GRINDERS—Miscellaneous

Brown & Sharpe #5 cyl., 3"x18", Blank Diamond
Brown & Sharpe #1, #2, #3 Univ., #13 Univ. & Tool
Cincinnati #2 Centerless Filmatic
Cincinnati Universal Filmatic, 12"x36", 12"x48"
Covel #91A Univ. Tool & Cutter
Gardner #22S, 30" disc. Heald #1 Tool
Heald #72A3 Int. Sizematic
J & L YG636 Thread Grinder
K. O. Lee Tool & Cutter
Landis #4H Cyl. 4"x12", #6 Thread, Landis Centerless
Norton #2 Tool & Cutter, Porter Cable Belt WG8
Oliver #510 Drill Pointer, Sellers #4G
Pratt & Whitney Radius #R6, Greeby Int.

GRINDERS—Surface

Abrasive #34 Vertical, #33
Atlantic 6x18" Power Feed, Foote-Burt Hammond
Blanchard #11—10" chuck, Brown & Sharpe #2
G. & L., #2S, #3S Hyd., 6x18" & 6x24"
Hanchett 2-300, 12x40", Mattison 14x18x48 Hyd.
Norton 6x18" Hyd., Pratt & Whitney 12x60" Vert.
Reid #2A P.F., #2C Pope & Excello Spdl.
Thompson Hyd. 6x10x18", 6x12x18

LATHES

Bradford 14"x6', Hardinge Precision 9", sidhinet
Hendey G. H. 16x36 with relieving att.
LeBlond Regal 10"x3½", 15x30", 19x48", 21x60"
Lodge & Shipley 16x28" T.A., LeBlond HD 16x33"
Monarch 10"x20" EE, 10"x20" T.A., 12x36" CKK
Monarch Model CKK 12x30" Dble. Compound
Rivett Precision, Logan 10"x30"
South Bend 9"x3', 9"x3½', 13x30", 19" Cabinet
Sebastian 12"x4', G.H., Sheldon 11x24, 1" collet

LATHES—Turret

Acme 4W, 6W, Bar and Chuck, 6W Fox Lathe
Bardons & Oliver #3, #5, Foster #3B
Brown & Sharpe #1, #2F Hand Screw Mach.
Gisholt #4, 5 Bar & Chuck—2L Saddle type
Hardinge ESM, 2nd operation
Jones & Lamson #8A Univ., Saddle, Threading
Oster #501 Rapiduction
Warner & Swasey #3, #4, #5, #4A—6" Bar Cap.

MILLS—Plain & Universal

Brown & Sharpe #2B Pl., #2A Univ.
Cincinnati #3 Plain, 2M M Univ.
Milwaukee 2H, Plain, #2HL, 2H, Univ.
Van Norman #12, 20, 22L, 36 Kempsmith 2G

MILLS—Vertical—JIG BORERS

Brown & Sharpe #2, Index, Vernon, Bridgeport
Cincinnati #4, Jackson
Gorton #3D, 9J Plain, #9½D Duplicator
Kearney & Trecker #5H, 3H High Speed D.T.
P&W 1½B Jig Borer, Sip Jig Borer #NP-5
Moore Jig Grinder, Vernon Jig borer
Morey #12M Profiler 2 sp.—Pratt & Whitney 12B

MILLS—Production

Brown & Sharpe #000, 12, 2I
Cincinnati #1-12, 1-18, 2-18 Mfg.
Nichols Hand, U.S. MM 1, Kent Owens #1V
Sundstrand #00 Rigidmills, U. S. Duplex

PRESSES

Bliss #8 Dbl. Crank, Bed 42x96", 250 Ton
Bliss #675, 645B, 650 Hi-Production, 304A, 305A
Bliss 400 DBL Crank, D.A., Toggle, Bed 40x54
Bliss #2B, 2I O.B.I., #4½ Double Action Cam
Bliss #58 OB, Gap Frame #62, 62A, 162
Ferracute Notching #C62
General Flexible Electric Screw Press
Henry & Wright 25, 75 Ton Dialog
Reliance #45 O.B.I.
V. & O. #102 Reducing
Zeh and Hanneman 30 tons

MISCELLANEOUS

BAND SAW: DoAll ML and Contour, Tannewitz #36M
BENDING ROLL: Buffalo #9, Excelsior #14
BROACH: 3L LaPointe Horiz. Hydr.
HACKSAW: Marvel #6A Automatic, #6, #4B
HONER: Micromatic #H-1 Hydrohoner, Sunnen
KEYSEATER: Mitts & Merrill, Baker, Davis, Barr
RIVET HAMMERS: HI Speed, all sizes, Chic. Pneumatic
ROUTER: Onsrud #W240, #55 Oliver
SHAPER: 32" G. & E. Universal
TAPPERS: Bakewell #1, Haskins #2C, 3C
VERTICAL SHAPER: 6" Pratt & Whitney
WELDERS SPOT & SEAM Taylor Winfield, Elsler 50 KVA, Thompson
WRAPPING ROLL: Buffalo #1½

HYDRAULIC EQUIPMENT

Cap.	Manufacturer	Platen	Stroke	Opening
500 Ton	Lake Erie	83x36"	36"	66"
600	Bald. Sf'thw'k	70x30"	22"	84"
500 D.A.	H.P.M.	38x36"	24"	36"
1000	French Oil	53x42"	20"	80"
350	Verson	48x48"	36"	72"
50	Dennison	22x20"	18"	23"
150	Southwark	34x30"	30"? to 4'	

UP MOVING RAM PRESSES

3000 Ton Tryout and Hobbing
300 Ton Watson-Stillman Hobbing, NEW.
600 Ton Birdsboro 42x32 plates—20" stroke
900 Ton Birdsboro 48x32 plates—20" stroke
800 Ton Birdsboro 40x32 plates—20" stroke
600 Ton Southwark 54x25 plates—20" stroke
100-150 Ton Stokes self contained Molding
300 Ton Dunning and Boschart Molding Press
300 Ton Watson-Stillman 24x20 plates — 8" stroke
500 Ton Self Contained Shaft Straightener.
225—500—600 Ton Wheel Presses

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MONA MEMBER

LATE TYPE MACHINE TOOLS

AUTOMATICS
6" RPA-8 Acme-Gridley Chucker, 1941.
16" Bullard Mult-Au-Matic, 6 spdl. 1941.
2⅝" RA-8 Acme-Gridley, 1943.
1⅝" Greenlee, 6 spindle, 1942
9/16" RA-6 Acme-Gridley, 1942.
No. 60 New Britain, 1" cap, 1943.

BORING MACHINES
No. 42 Lucas Horizontal, 1940.
No. 54 Excello Double End, 1940.
No. 46B Heald Single End, 1940.

DRILLS
5' 15" Cincinnati-Bickford, 1942.
3' 9" "Mor-Speed", Latest.
25" Fosdick "Economax", 1941.
No. 217 Baker, box column, 1942.
No. 5 BM Fosdick, box column, 1942.

GEAR EQUIPMENT
3" Gleason Generator, 1941.
No. 6 & 17 Gleason Testers, 1943.
12" Red Ring Internal Shaver, Late.
No. GCL Red Ring Shaver, 1942.
No. 624A3 Fellows Side Trimmer, New.
No. 615A & 61A Fellows Shapers, 1943.
No. 7125A & 712 Fellows Shaper, 1943.
Vinco Spline & Gear Grinder, 1942.

GRINDERS, CYLINDRICAL
25"x48" Landis, Crankshaft, Like New.
16"x36" Cincinnati Plain, 1942.
12"x48" Cincinnati Univ, 1943.
10"x72" Landis Plain, 1942.
10"x18" Norton Plain, 1942.

GRINDERS, INTERNAL
No. 74 Heald Ext. Bridge, 1941.
No. 72A3 & A5 Heald Plain, 1944.
No. 5 & 16A22 Bryant, Latest.

GRINDERS, SURFACE
12"x16"x60" Thompson Hyd. Latest.
No. 22 & 25A Heald Rotary, 1943.

LATHES, ENGINE
45"x192" Axelson, 1942.
28"x276" Bertram, 1942.
24"x168" Sidney, 1942.
18"x54" Lodge & Shipley, 1943.
18"x48" Bradford, 1942.

LATHES, PRODUCTION
Gisholt "Simplimatic", 1940.
No. 3A L&S "Duomatic", 1943.
No. 2FJ Foster "Fastermatic", 1943.
8"x108" Lo-Swing Semi. Auto. 1942.
Model 8, 10 & 12 Sundstrand, 1942.
14"x42" Monarch "Magna-Matic", 1941.
20"x25" Fay Automatic, 1942.

LATHES, TURRET
42"x36" Bullard Vertical, 1943.
No. 2A & 3A Warner & Swasey, 1943.
No. 1 & 8½"x24" Acme Univ. 1943.
No. 2, 3 & 4 Warner & Swasey, 1943.
No. 3, 5 & 7 Bardons & Oliver, 1942.

MILLS, PLAIN
No. 5 Cincinnati, 1943.
No. 4 Cincinnati Dial Type, 1942.
No. 4H & 4K Milwaukee, 1943.
No. 3 Van Norman, 1942.
No. 2HL Milwaukee, 1942.

MILLS, PRODUCTION
BL 2416 P&W "Keller", 1 sp. 1943.
BG-1 Keller, single spdl.
No. 1-14 & 2-20 Kent Owens, 1942.
No. 1224 Kearney & Trecker, 1942.
No. 3-35 Cincinnati Duplex, R & F, 1942.
No. 1-18, 2-18 & 2-24 Cincinnati, 1942.

MILLS, THREAD
6"x60" Pratt & Whitney, Latest.
12"x24" Lees Bradner, 1943.
4"x9" Hanson Whitney, Late.

MILLS, UNIVERSAL
No. 2MH Cincinnati, 1942.
No. 2H Milwaukee, 1942.
No. 25U & 26SU Van Norman, 1942.

MILLS, VERTICAL
No. 3B P&W Univ. Die Sinker, 1943.
No. 2K & 3H Milwaukee, 1942.
No. 2 & 3 Cincinnati, 1942.
No. 1 Cleveland, 1942.

PRESSES
No. 40—55½ Minster, 1942.
100 Ton Hamilton, Hyd. Str. 1942.
50 Ton Denison, Hyd. Str. 1942.

INDIANAPOLIS MACHINERY & SUPPLY CO.
1961 S. Meridian St.
INDIANAPOLIS 6, IND.

MAN HOUR Savers

AUTOMATIC SCREW & CHUCKING MACHINES

B. & S. #6 auto. motor-in-base 2½" hole, 505 max. rpm.
B. & S. #2G, auto. ⅞" cap. 1240 max. rpm.
Nat'l Acme RA 9/16", spdls. 6, 2885 max. rpm, tooling & attachments, (very late).
Potter & Johnson #6DRE Auto. chucker, 34" swing, 5 face turret, Timken bearing, tooling.

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Jones & Lamson #5, 2½" cap. ram type Universal, rpd. trav. to cross slide, bar and chucking.
Gisholt #5, 2½" cap., ram type Universal, Preselec. hd., thread attchmt., bar and chucking, tooling.
Jones & Lamson #7A, 2½", #8A, 3", #7D, 2½", saddle type, univ., rpd. trav., bar and chucking, tooling.

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Defiance 25A, 3¼" bar, face plate to outer support 72", #6 taper, added vert. and cross range (late).
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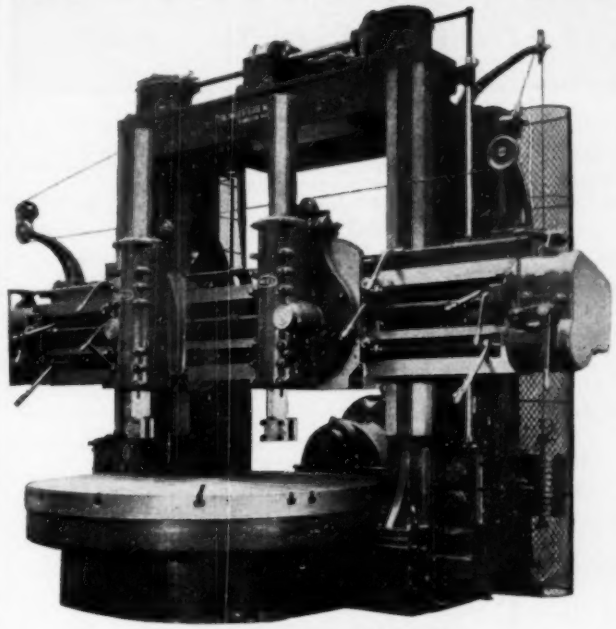

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INDEX OF PRODUCTS ADVERTISED IN THIS ISSUE

Abrasives, Coated 18-19

Accessories & Attachments (Machine Tool) 20, 170, 174, 182, 184, 194, 197, 201, 212

Balers, Scrap Metal 53

Bearings 16, 197, 202

Books, Technical 188, 193, 203, 207

Boring, Drilling & Milling Machines (Horizontal) 4-5, 14, 29, 38-39

Boring & Turning Machines (Vertical) 157

Chucks 178-179, 182, 198, 203

Cleaning & Drying Machines & Supplies 206

Compressor's, Air 185

Controls, Electrical 30-31, 145

Coolant Systems, Filters & Supplies 190, 196, 202

Cut-Off Machines; Sawing Machines 60, 201, 208

Disintegraters, Metal 180

Dressers, Wheel 212

Drilling Machines 28, 48, 58, 65, 121, 124, 152, 199, 202, 209

Electrical Parts & Equipment.....22-23

Engineering & Production Services 165

Fabricating Methods & Services ..176, 201

Fasteners 170, 206

Gages & Instruments 33, 36-37, 55, 62, 168, 196, 206, 211

Gear Cutting Machines 3, 6-7, 52, 137, 188, 210

Gears, Speed Reducers, Motor Reducers 199, 204, 206, 208, 211

Gear Testers 3, 6-7, 199

Grinders—Cutter & Tool 180, 204, 210, 212

Grinding Machines—Production.....2nd Cover, 12-13, 25, 36-37, 45, 183, 207, 211

Heat Treating Equipment & Supplies 47, 160, 208

Hydraulic & Pneumatic Parts & Equipment 160, 166

Jig Borers 24

Lathes, Automatic 40, 59, 61, 128

Lathes, Engine .....3rd Cover, 21, 46, 54, 143, 158

Lathes, Turret 50, 177

Lubricants, Cutting Fluids, Quenching Oils & Solvents.....26-27, 41, 70, 147, 173, 196, 211

Machines, Super Finishing 44

Marking Machines & Tools 150, 210

Materials, Cutting & Forming.....126, 186

Materials of Manufacture.....4th Cover, 34, 63, 126, 135, 153, 155, 171, 186

Materials Handling Equipment 154

Mechanical Parts & Equipment 170, 174, 182, 206

Millers, Die Sinkers, Profilers 4-5, 8-9, 17, 29, 38-39, 172, 184, 208

Motors, Electrical 49, 163, 175

Oil Purifiers 190

Planers 15

Polishing & Buffing Machines 139

Power Transmission 22-23, 32

Presses, Forging & Forming Equipment & Supplies 42-43, 66, 72, 141, 149, 151, 162, 166, 170, 187, 199, 201, 210

Pumps, Circulating 196, 202

Riveting Machines 208

Safety & Welfare Equipment 192

Screw Drivers, Power 209

Screw Machines; Chucking Machines 40, 59, 128, 195, 197

Shapers, Slotters, Keyseaters 184, 202

Stampings 211

Swaging Machines 156

Tapping Attachments 158, 194

Tapping Machines 28, 58, 121, 124, 152

Thread Cutting Machines 10-11, 201

Tools, Cutting 10-11, 20, 35, 51, 56, 57, 122, 156, 169, 181, 191, 205, 210, 211, 212

Tools, Hand 182, 187, 189, 191

Tools, Portable 167, 170

Transportation 205

Turret Attachments, Lathe 212

Vibration Control 159, 204

Vises 186

Welding & Cutting, Brazing & Soldering Equipment & Supplies 161

Wheels, Abrasive 18-19, 164

ADVERTISERS INDEX

	Page
Abbott Ball Co.	197
Acromark Co.	210
Air Reduction	161
Allis-Chalmers Mfg. Co.	32
Allison Co.	164
American Magnesium Corp.	63
American Optical Co.	192
American Steel Foundries, Elmes Engineering Div.	151
American Tool Works	21
Apex Machine & Tool Co.	182
Armstrong-Blum Mfg. Co.	56
Armstrong Bros. Tool Co.	20
Arter Grinding Machine Co.	207
Atkins & Co., E. C.	181
Auto Engine Works, Inc.	208
Ball & Roller Bearing Co.	202
Barber-Colman Co.	52
Baumbach Mfg. Co., E. A.	210
Bellows Co.	166
Bemis & Call Co., Inc.	197
Bethlehem Steel Co.	126
Birdsboro Steel Foundry & Machine Co.	141
Black & Decker Mfg. Co.	167
Blanchard Machine Co.	25
Brown & Sharpe Mfg. Co.	36-37
Bryant Machinery & Engineering Co.	28
Bullard Co.	61
Butterfield Div. of Union Twist Drill Co.	169
Card Mfg. Co., S. W.	57
Carlton Machine Tool Co.	202
Century Electric Co.	163
Cimcool Div., Cincinnati Milling Machine Co.	41
Cincinnati Bickford Tool Co.	65
Cincinnati Gear Co.	204
Cincinnati Milling Machine Co.	4-5
Cincinnati Planer Co.	15
Cincinnati Shaper Co.	72
Clemson Bros., Inc.	156
Cleveland Crane & Engineering Co.	42-43
Columbus Die Tool & Machine Co.	201
Cone Automatic Machine Co.	59
Consolidated Machine Tool Corp.	17
Cross Co.	121
Crucible Steel Co. of America	155
Danly Machine Specialties, Inc.	66
Davis & Thompson Co.	209
Davis Keyseater Co.	202
Dayton Rogers Mfg. Co.	211
Detroit Die Set Corp.	170
Detroit Power Screwdriver Co.	209
Dickerman Mfg. Co., H. E.	174
Disston & Sons Inc., Henry	189
Eastern Machine Screw Corp.	211
Eastman Kodak Co.	199
Elmes Engineering Div., American Steel Foundries	151
Elox Corporation	180
Errington Mechanical Laboratory	212
Ex-Cell-O Corporation	157
Federal Press Co.	149
Fellows Gear Shaper Co.	6-7
Felters Co.	159
Foote-Burt Co.	124
Fosdick Machine Tool Co.	48
Gallmeyer & Livingston Co.	204
Ganschow Gear Co.	206
General Electric Apparatus Dept.	22-23, 30-31
Giddings & Lewis Machine Tool Co.	14
Gisholt Machine Co.	44, 50
Gleason Works	3
Goss & de Leeuw Machine Co.	197
Grant Gear Works	211
Grant Mfg. & Machine Co.	208
Greaves Machine Tool Co.	208
Grob Brothers	208
Gulf Oil Corp.	173
Hamilton Tool Co.	152
Hardinge Brothers, Inc.	195
Harrington & King Perforating Co.	199
Hartford Special Machinery Co.	139
Heald Machine Co.	2nd Cover
Hendey Machine Co.	143
Holman Reamer Co.	210
Honan Crane Corp.	190
Hones, Inc., Charles A.	208
Howell Electric Motors Co.	175
Hunt Spiller Manufacturing Co.	171
Ingersoll-Rand Co.	185
J & S Tool Co.	212
Jacobs Mfg. Co.	178-179
Jarvis Co., Charles L.	158
Jones & Lamson Machine Co.	55
Jones & Laughlin Steel Corp.	135
Kaukauna Machine Corp.	28
Kearney & Trecker Corp.	29
Korfund Co., Inc.	204
L-W Chuck Co.	201
Landis Machine Co.	10-11
Landis Tool Co.	12-13
LaSalle Steel Co.	153

ADVERTISERS INDEX

	Page
LeBlond Machine Tool Co., R. K.	3rd Cover
Lees Bradner Co.	188
Leland-Gifford Co.	199
Lindberg Engineering Co.	47
Link Belt Co.	16
Lodge & Shipley Co.	54
Louisville Electric Mfg. Co.	170
Luers, J. Milton	210
Lufkin Rule Co.	196
Mahon Co., R. C.	176
Mattison Machine Works	45
McGraw-Hill Book Co., Inc.	188, 193, 203
Mead Specialties Co.	160
Meisel Press Mfg. Co.	199
Michigan Tool Co.	137
Milwaukee Foundry Equipment SPO, Inc.	53
Monarch Machine Tool Co.	46
National Acme Co.	40
National Automatic Tool Co.	58
National Machine Tool Co.	205
National Tool Co.	33
Newark Gear Cutting Machine Co.	210
New Britain Gridley Machine Co.	128
Nicholson File Co.	191
Noble & Westbrook Mfg. Co.	150
North Bros. Mfg. Co.	186
Norton Co.	18-19
Oakite Products, Inc.	206
Oliver Instrument Co.	210
O'Neil-Irwin Mfg. Co.	166
Ottemiller Co., Wm. H.	206
Parker Rust Proof Co.	213
Pratt & Whitney Div., Niles-Bement-Pond Co.	24
Precise Products Co.	184
Procunier Safety Chuck Co.	194
Prosser & Son, Thomas	180
Railway Express, Air Express Div.	205
Randall Co., Inc., Frank E.	206
Reed-Prentice Corp.	172
Reid Bros. Co., Inc.	211
Rodgers Hydraulic, Inc.	187
Ruthman Machinery Co.	202
Sentry Co.	160
Severance Tool Industries, Inc.	205
Sheldon Machine Co.	184
Shore Instrument & Mfg. Co., Inc.	211
Sier Bath Gear & Pump Co., Inc.	206
Simonds Saw & Steel Co.	64
Sinclair Refining Co.	26-27
Snyder Tool & Engineering Co.	165
Socony Vacuum Oil Co., Inc.	147
Square D Co.	145
Stahl Gear & Machine Co.	208
Standard Conveyor Co.	154
Standard Pressed Steel Co.	170
Standard Tool Co.	51
Starrett Co., L. S., The	122
Steelweld Machry. Div., Cleveland Crane & Engineering Co.	42-43
Stuart Oil Co., D. A.	211
Sundstrand Machine Tool Co.	38-39
Sundstrand Magnetic Products Co.	203
Texas Co.	70
Thompson Grinder Co.	183
Timken Roller Bearing Co., Steel & Tube Div.	4th Cover
Toledo Scale Co.	168
Torrington Co.	156
Tuthill Pump Co.	196
Union Twist Drill Co.	35
U. S. Automatic Box Machinery Co.	170
V & O Press Co.	210
Van Keuren Co.	62
Van Norman Co.	8-9
Walker Co., Inc., O. S.	198
Walker Turner Div., Kearney Trecker Corp.	60
Waltham Machine Works	201
Warner & Swasey Co.	177
Weldon Tool Co.	212
Westinghouse Electric Corp.	49
Wheelock Lovejoy & Co., Inc.	186
Whistler & Sons, S. B.	162
White & Bagley Co.	196
Wilson Mechanical Instrument Co.	211
Youngstown Sheet & Tube Co.	34

SEARCHLIGHT SECTION
(Classified Advertising)

	Page
EMPLOYMENT	
Positions Vacant	214
Selling Opportunities Offered	214
Positions Wanted	214
Selling Opportunities Wanted	214
Employment Services	214
SPECIAL SERVICES	
Contract Work	214
Francis Metal Products Corp.	214
General Pattern Works	214
Hartmeister Mfg., Inc.	214
BUSINESS OPPORTUNITIES	
Offered	214
Wanted	214
EQUIPMENT (Used or Surplus New)	
For Sale	214-221
WANTED	
Equipment	220

ADVERTISERS INDEX

Aaron Machinery Co.	219
Avico, Inc.	220
Bennett Machinery Co.	221
Botwinik Bros. of Mass., Inc.	220
Brownell, Hazard Machine Tools, Inc.	220
Dony Machinery Co., D. E.	220
Eastern Machinery Corp.	221
Falk Machinery Co.	215
Hill-Clarke Machinery Co.	216
Hyman & Son, Joseph	218
Indianapolis Machy. & Supply Co.	220
Industrial Technics	214
Kagan Engineering Shop, Paul	220
Kings County Machinery Exchange	218
Le Bryan Groups Products	214
Liberty Planners, Inc.	218, 220
McDonald Machinery Co.	216
Miles Machinery Co.	219
Morey Machinery Co.	217
Mutual Positions Plan Associates	214
National Machinery Exchange	216
Osborne & Sexton Machinery Co.	218
Paul's Machinery Co.	220
Peerless Iron Works, Inc.	214
R & H Machinery, Inc.	218
Randall Co., The	221
Roberts Screw Products	214
Samuel Machinery Co.	214, 218
Seaboard Steel Co., Inc.	220
Simmons Machine Tool Co.	216
Tobias & Co., D. F.	214
Triplex Machine Tool Corp.	218
West Penn Machinery Co., Inc.	220
Winston Machinery Co., Inc.	218, 220, 221

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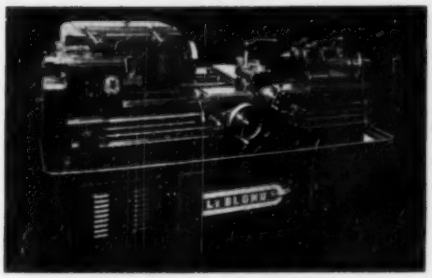

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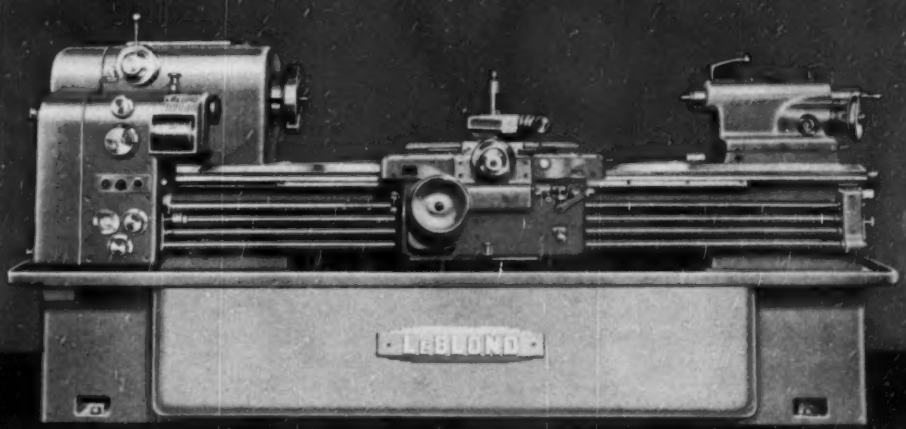

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LeBLOND

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Our tube engineering service makes even greater savings possible because our engineers choose the most economical size tube for you . . . and it's guaranteed to clean up to exacting finished dimensions. This tube engineering service is recognized and proved. That's why 90% of Timken tubing is bought on this basis.

3. *Superior forged quality improves the finished product*

Timken seamless tubing is made by a process that is basically a forging operation. Red hot billets are forced over piercing points by rolls that work the steel with a kneading, spiral action, giving Timken tubes uniform, spiral grain flow and refined grain structure. And foot-a-second piercing stops heat loss, assures uniform quality from one end to the other. Why not get the complete story on Timken tubing from our Technical Staff? Also ask for a free copy of our informative, 68-page booklet, "Facilities and Products". Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.